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A Dozen New Nematode Species from Hungary

By

I. Andrássy*

Abstract. In the present article three new genera and twelve new species of Nematoda are described from Hungary. *Seleborca* gen. n. (Cephalobidae, Acrobelinae) is similar to *Acrobeles* but differs from it by the double cuticle and the structure of the lateral field. *Hoplorhynchus* gen. n. (Hoplolaimidae, Rotylenchinae) is unique among the genera of Hoplolaimidae in the structure of lateral field, in the shape of tail and in the location of phasmids. *Labronemella* gen. n. (Qudsianematidae) resembles *Labronema* but has a discolaimoid head and a very slender spear. The new species are: *Penzancia terricola, Theristus pannonicus, Metateratocephalus gracilicaudatus, Acrobeles canalis, Caenorhabditis cervi, Hoplorhynchus riparius, Ogma danubiale, Ogma castellanum, Trischistoma gracile, Aulolaimus autumnalis, Labronema pusillum* and *Labronemella labiata* spp. n.

The genera *Penzancia* (de Man, 1889) Filipjev, 1918, *Acrobeles* Linstow, 1877, *Trischistoma* Cobb, 1913, *Tripylina* Brzeski, 1963 are redefined and their species listed. To each genus *Metateratocephalus* Eroshenko, 1973, *Acrobeles* Linstow, 1877, *Seleborca* gen. n., *Trischistoma* Cobb, 1913, *Tripylina* Brzeski, 1963, *Aulolaimus* de Man, 1880 and *Labronemella* gen. n. a key is given.

As mentioned in a recent paper (Andrássy, 1982), 503 free-living nematode species have been recorded from Hungary to now. In addition to this number, I give here the descriptions of further twelve species new not only for the Hungarian fauna but also for science. Besides, two new genera are proposed and some older genera are redefined as well. To facilitate recognizing the species, keys to five genera are added.

Penzancia terricola sp. n.

(Fig. 1 A–F)

♂: L = 1.06–1.08 mm; a = 40–42; b = 5.4; c = 8.5–8.8; c' = 5 –5.5

Cuticle very thin, finely annulated; annules 1.2–1.4 μm wide on the midbody region. Somatic setae scattered, short, about as long as 1/4 body diameter. Head somewhat swollen, 16 μm wide; body at the posterior end of oesophagus 1.5 times wider than head. Cephalic setae: 4×2 submedial and 2×2 lateral. Submedial setae 14 μm and 11–12 μm , 88% and 68–75% of labial diameter, respectively. Length of shorter lateral setae about 40% of the longer ones. Labial papillae setiform.

Amphids circular, 5.8–6 μm wide, 33–35% of the corresponding body diameter, their anterior margin is situated at 20–21 μm (1.2–1.3 head diameter) from anterior body end. Vestibulum fairly wide, 8×5 μm. Oesophagus

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cylindrical, 196 – 200 μm long. Cardia offset, spherical, with a small tongue-shaped posterior process. Beginning of intenstine somewhat widened, forming the so-called progaster. In the lumen of the intestine rests of algae can be observed.

Testis beginning at about 4 body widths behind oesophagus. Spermatozoa minute, globular. Spicula 30 μm long (along the arc), with twisted lateral edges. Gubernaculum about 15 μm long, characteristic in shape (see Fig. 1D), on both sides with a distal triangular plate. Tail ventrally curved, 122 – 124 μm long, 5.2 times as long as anal body diameter, possessing 10 pairs of subventral and 9 – 10 pairs of subdorsal setae. Tail spinneret short.

Females were not found. The juveniles correspond to the above description of the males, their amphids were, however, a little smaller and the tail was somewhat longer.

Holotype: A male specimen with slide number H – 7247 in the collection of the author.

Type locality: Budapest, Hungary, soil around roots of maize in a garden, April 1961.

The new species is a representant of the species group "*Theristus flevensis*" which, according to WIESER and HOPPER (1967), comprises the following species: *Th. ambronensis* SCHULZ, 1935, *Th. bipunctatus* (SCHNEIDER, 1906) FILIPJEV 1929, *Th. borosi* ANDRÁSSY, 1958, *Th. calx* WIESER & HOPPER, 1967, *Th. flevensis* SCHUURMANS STEKHOVEN, 1935, *Th. macroflevensis* GERLACH, 1954, *Th. metaflevensis* GERLACH, 1955, and *Th. parambronensis* TIMM, 1952. This group of the old genus *Theristus* may be characterized by the structure of the spicular apparatus: the spicula are arched with twisted lateral edges, and the gubernaculum has a distal triangular plate on both sides. All species mentioned above are marine or inhabitants of inland salt waters. Only SCHIEMER (1978) found *Th. flevensis* in the Neusiedler Lake, Austria, a fresh water habitat. *Penzancia terricola* sp. n. can be distinguished from the members of the *flevensis* group by the fine structure of the spicula and gubernaculum, the number and length of the lateral cephalic setae (there are one or three lateral setae in the other species) and the terrestrial occurrence.

When redescribing the species *Monhystera velox* (BASTIAN, 1865), DE MAN proposed a new subgenus: *Monhystera* (*Penzancia* DE MAN, 1889), and designated some years later (in STILES and HASSAL, 1905) the same species as a type. FILIPJEV (1918) raised *Penzancia* to generic rank, whilst WIESER (1956) considered it a subgenus of *Theristus*. The latter author proposed a new type-species, *Theristus flevensis* SCHUURMANS STEKHOVEN, 1935, being BASTIAN'S uncertain *Theristus velox* a species inquirenda.

BASTIAN (1965) described *Th. velox* on the basis of a female specimen, so that in lack of male his species cannot be recognized, indeed. If the type-species remains an inquirenda, the genus *Penzancia* ought to be rejected as well and regarded only as a "genus inquirendum". However, this genus has generally been used by marine nematologists and a good number of species have been ordered and described in it. I think that it would be advisable to keep *Penzancia*, and propose therefore the solution as follows. As mentioned, DE MAN (1899) found a species in the English Channel and identified it as *Monhystera (Penzancia) velox* (BASTIAN, 1865) BÜTSCHLI, 1874. Both the description and the locality well agreed with those of BASTIAN, consequently this species of DE MAN

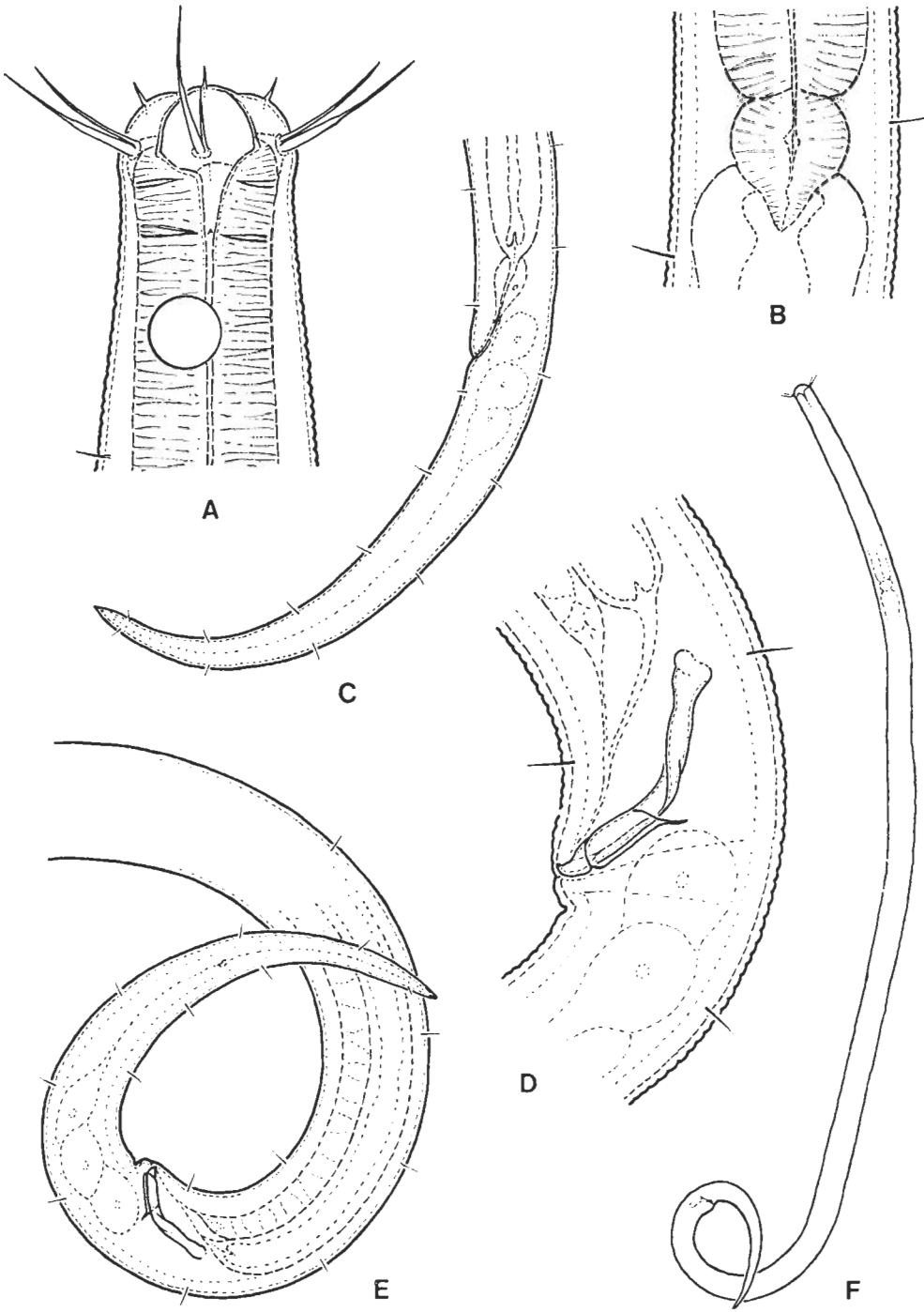

Fig. 1. *Penzancia terricola* sp. n. A: anterior end (1600×); B: cardial region (1200×); C: female tail (570×); D: cloacal region of male (1200×); E: posterior body end of male (570×); F: entire male (150×)

could justly be accepted as a representative of *velox*. *Penzancia* may remain in this manner a valid genus and characterized by its type, *Penzancia velox* (BASTIAN, 1865) FILIPJEV, 1918 sensu DE MAN, 1889.

Penzancia has been explained by different authors in different manner. WIESER (1956) enumerated 14 species, WIESER and HOPPER (1967) 19 species, GERLACH and RIEMANN (1973) 38 species. I restrict the genus to the „*flevensis* group" and give below an emended dignosis.

Penzancia (DE MAN, 1889) FILIPJEV,, 1918

Syn. *Monhystera* (*Penzancia* DE MAN, 1889); *Theristus* (*Penzancia* DE MAN, 1889) WIESER, 1956.

Xyalide. Cuticle finely annulated, with thin submedial setae. Head bearing four pairs of submedial setae and one to three lateral setae on each side. Cephalic setae not articulate. Ocelly generally present. Mouth cavity without conspicuous denticles. Amphids circular. Vulva in 2/3 to more than 3/4 body length. Spicula arched, moderately long, with twisted lateral edges. Gubernaculum with a small dorsal process and with a distal triangular plate on both sides. Tail terminus simple, without setae.

Predominantly marine or occurring in inland salt biotopes; one species terrestrial.

Type-species: *Theristus velox* BASTIAN, 1865 sensu DE MAN, 1889 = *Penzancia velox* (BASTIAN, 1865) FILIPJEV, 1918.

The following 10 species may be included here:

P. ambronensis (SCHULZ, 1936) comb. n.
Syn. *Theristus ambronensis* SCHULZ, 1936
Theristus (Penzancia) ambronensis SCHULZ, 1936 (WIESER, 1956)

P. bipunctata (SCHNEIDER, 1906) comb. n.
Syn. *Monhystera bipunctata* SCHNEIDER, 1906
Theristus bipunctatus (SCHNEIDER, 1906) FILIPJEV, 1929
Theristus (Penzancia) bipunctatus (SCHNEIDER, 1906) FILIPJEV, 1929 (WIESER & HOPPER, 1967)

P. borosi (ANDRÁSSY, 1958) comb. n.
Syn. *Theristus borosi* ANDRÁSSY, 1958
Theristus (Penzancia) borosi ANDRÁSSY, 1958 (WIESER & HOPPER 1967)

P. calx (WIESER & HOPPER, 1967) comb. n.
Syn. *Theristus (Penzancia) calx* WIESER & HOPPER, 1967

P. macroflevensis (GERLACH, 1954) comb. n.
Syn. *Theristus macroflevensis* GERLACH, 1954
Theristus (Penzancia) macroflevensis GERLACH, 1954 (WIESER, 1959)

P. metaflevensis (GERLACH, 1955) comb. n.
Syn. *Theristus metaflevensis* GERLACH, 1955
Theristus (Penzancia) metaflevensis GERLACH, 1955 (WIESER, 1959)

P. parambronensis (TIMM, 1952) comb. n.
Syn. *Theristus parambronensis* TIMM, 1952
Theristus (Penzancia) parambronensis TIMM, 1952 (WIESER, 1959)

P. scanica (ALLGÉN, 1949) comb. n.
Syn. *Theristus scanicus* ALLGÉN, 1949
Theristus (Penzancia) scanicus ALLGÉN, 1949 (WIESER, 1956)
Theristus (Penzancia) heteroscanicus WIESER, 1956

P. terricola sp. n.

P. velox (BASTIAN, 1865) FILIPJEV, 1918
Syn. *Theristus velox* BASTIAN, 1865
Monhystera velox (BASTIAN, 1865) BÜTSCHLI, 1874
Monhystera (Penzancia) velox (BASTIAN, 1865) BÜTSCHLI, 1874 (DE MAN, 1889)
Theristus flevensis SCHUURMANS STEKHOVEN, 1935*
Theristus (Penzancia) flevensis SCHUURMANS STEKHOVEN, 1935 (WIESER, 1956)

Theristus pannonicus sp. n.

(Fig. 2A–F)

♂: L = 0.90 mm; a = 51; b = 5.3; c = 6.0; c' = 10.
Predault ♀: L = 0.64 mm; a = 44; b = 4.2; c = 7.0; V = 63%; c' = 8.

Cuticle very thin, finely annulated; annules on mid-body only about 1 μm wide, on the posterior body region somewhat wider. Cuticle scattered with very thin setae measuring about the half the body width.

Head 10 μm wide, not separated from body; at posterior end of oesophagus body 1.6–1.7 times as wide as head. Labial papillae setose, fairly long. Cephalic setae arranged as follows: 4×2 submedial setae and 2×1 lateral setae. The longer setae measuring 10 μm = one head diameter, the shorter ones only 65–70% of the former. Amphids large, 5.5–6 μm wide, about half as wide as corresponding body diameter (they are a little wider in the predault female), their anterior margin lying 13–14 μm from head end (1.3–1.4 head diameter).

Oesophagus 170 μm long, distance between oesophagus and vulva 1.6 times as long as oesophagus. Cardia spheroid, with a small posterior tongue-like process. Beginning of intestine set off (progaster). Distance between vulva and anus 1.6 times as long as tail.

Male tail 150 μm long, 10 times anal body diameter, ventrally curved, distinctly narrowing behind cloaca. Tail spinneret small. Spicula 42 μm long, 2.7 times as long as anal body diameter, slender, with somewhat widened anterior end. Gubernaculum slipper-like, encircling the posterior third of spicula.

Holotype: Male on slide No. H–4399 in the collection of the author.

Type locality: Keszthely, Hungary, soil from a wheat field, May 1967.

* Nomen novum by SCHUURMANS STEKHOVEN (1935) for *Monhystera velox* sensu DE MAN, 1922. DE MAN's species (1889 and 1922) is proposed here to accept as identical with *Theristus velox* of BASTIAN, 1965.

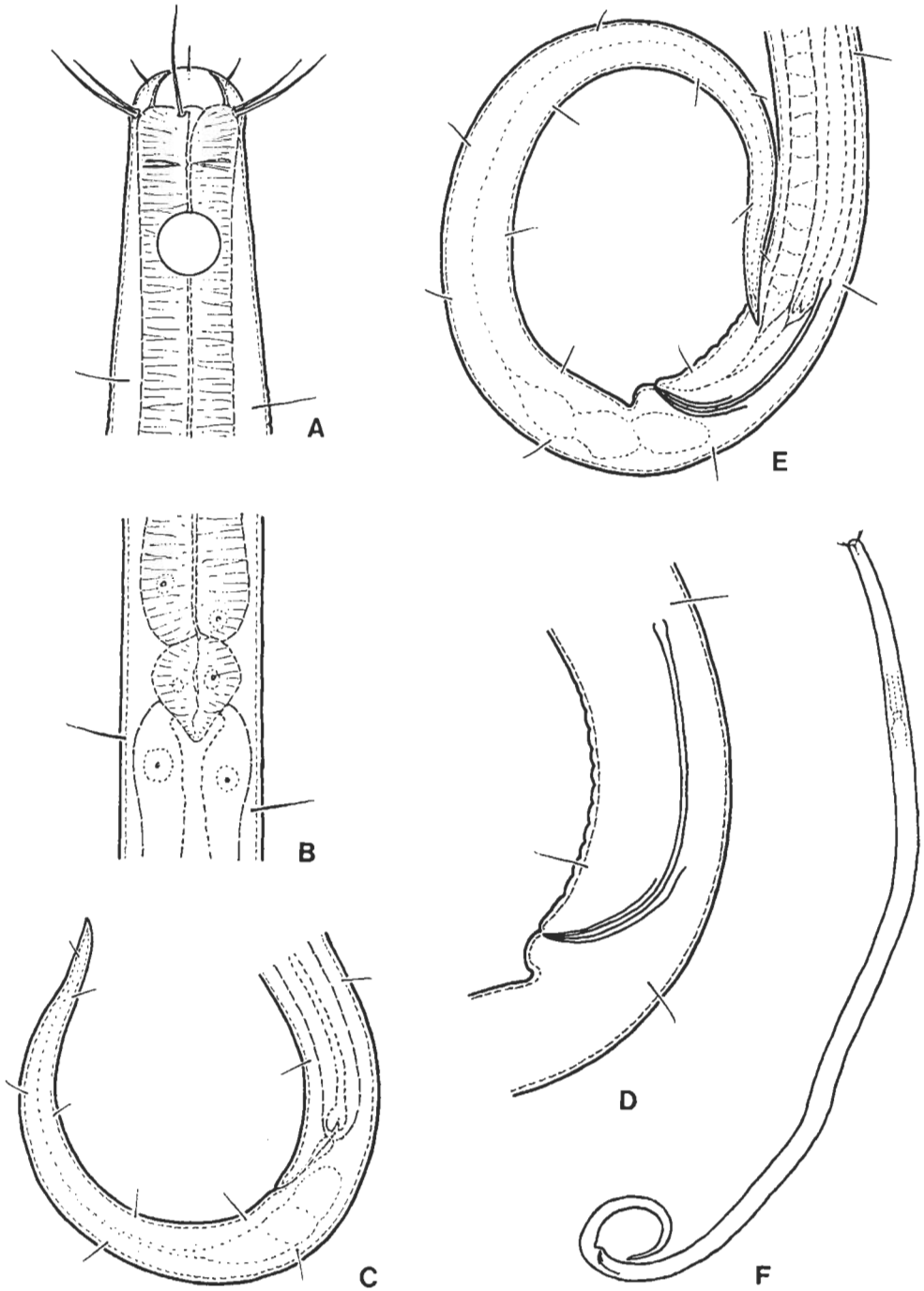

Fig. 2. *Theristus pannonicus* sp. n. A: anterior end (1600×); B: cardial region (1200×); C: female tail (800×); D: cloacal region of male (1200×); E: posterior body end of male (800×); F: entire male (150×)

In the shape and length of the spicula the new species resembles *Theristus ruffoi* ANDRÁSSY, 1959; the spicula of the latter are 48–50 μm long, 2.5–2.7 times as long as the anal body diameter. *Theristus pannonicus* sp. n. can be distinguished from *Th. ruffoi* as follows: the longer cephalic setae are as long as the diameter of head (in *ruffoi* 82–86% of head diameter), the amphids considerably larger (in *ruffoi* only 1/4 of the corresponding body width), the spicula a little shorter, and the body narrows characteristically behind the cloacal opening.

Metateratocephalus gracilicaudatus sp. n.

(Fig. 3A–G)

♀: L = 0.39–0.43 mm; a = 30–33; b = 3.7–4.1; c = 6.3–7.2; V = = 51–52%; c' = 7–8.

Cuticle very thin, 0.5–0.7 μm on the mid-body, very finely annulated and ornamented with minute dots somewhat stronger on the lateral fields, especially in the posterior portion of body. Lateral fields about 1/3 as wide as body width.

Head 9.5–10.5 μm wide, sharply offset, considerably wider than adjacent body region. Labial regon divided into six lobes with strongly cuticularized edges, each bearing a bristle-like tip. Amphids circular or crypto-spiral, 5 μm wide, about 1/3 as wide as corresponding body width, situated 15–17 μm or 1.5–1.7 head diameters from anterior body end.

Buccal cavity relatively wide, cheilostom funnel-shaped, heavily cuticularized, promesostom cylindrical, thin-walled. Oesophagus almost cylindrical, 100–104 μm long, terminal bulb strong, spherical or ovoid. Rectum 1.5 times as long as anal body diameter. Distance between oesophagus and vulva nearly as long as oesophagus.

Female gonads paired and reflexed, rather short, each branch 2.2–2.5 times as long as body diameter. Vagina short. One egg in the uterus: 37–43×11–12 μm, 2.8–3.2 times body diameter.

Distance between vulva and anus 2–2.5 times as long as tail. This latter 56–62 μm long, 7–8 times anal body diameter and 14–16% of entire body length, respectively, conical, strongly bent dorsally in its 2/3 part. Tail tip filiform. Phasmids unrecognizable.

Male was not found.

Holotype: Female on slide No. H–9732 in the collection of the author.

Type locality: Nyírestó, Hungary, *Sphagnum* moor, March 1983, leg. GY. KERTÉSZ.

When established the new genus *Metateratocephalus*, EROSHENKO (1973) designated *M. typicus* EROSHENKO, 1973 as type-species. As second species, he transferred *M. crassidens* (DE MAN, 1880) EROSHENKO, 1973 from the genus *Euteratocephalus* ANDRÁSSY, 1958. The differences between both species are, however, so little (amphids spiral or crypto-spiral, oesophageal bulb rounded or somewhat angular, respectively) that the species cannot be separated from each other. I synonymize therefore *typicus* with *crassidens*.

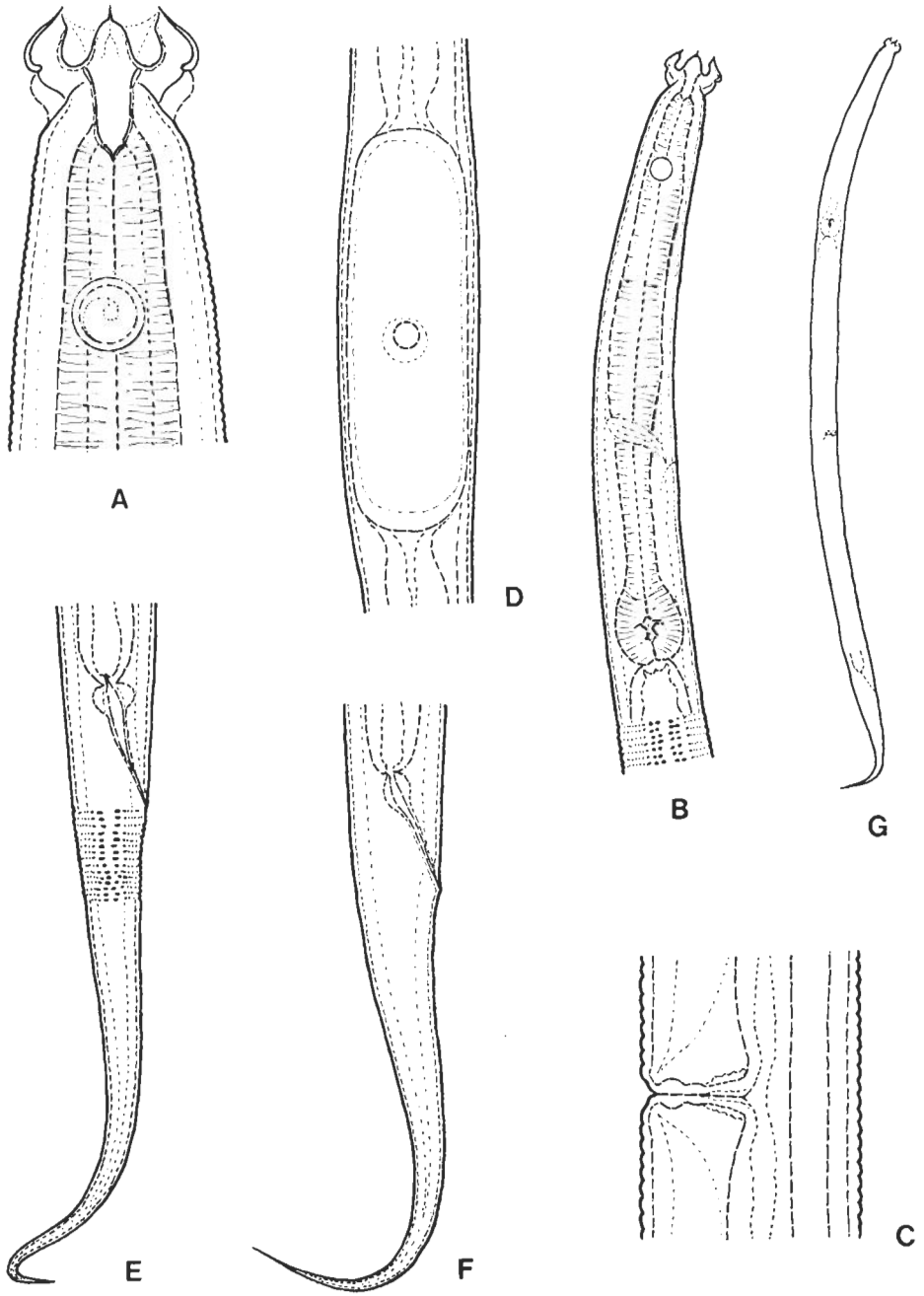

Fig. 3. *Metateratocephalus gracilicaudatus* sp. n. A: anterior end (2500×); B: oesophageal region (800×); C: vulva (1600×); D: egg in the body (1200×); E – F: tail forms of females (1200×); G: entire female

On the other hand, however, it seems hardly questionable that the species described by DE CONINCK (1935) from Zaire as *„Teratocephalus crassidens"* is not identical with DE MAN's *crassidens*. It distinguishes from the latter by the amphids located 3 head diameters behind the anterior end (1.5 – 2 head diameters in *crassidens*), the weak punctation of cuticle also on the lateral fields (punctation much heavier on the lateral fields in *crassidens*), and the tail showing a mucro-like tip (not mucronate in *crassidens*). I considered it a separate species and proposed the name *Metateratocephalus deconincki* ANDRÁSSY, 1984 (Syn. *Teratocephalus crassidens* apud DE CONINCK, 1935 nec DE MAN, 1880).

Metateratocephalus gracilicaudatus sp. n. can be separated from both *crassidens* and *deconincki* in having a more slender body, a wider head, and a much longer, filiform tail.

Key to the species of Metateratocephalus

1 Tail 7 – 8 times anal body diameter, very finely attenuated. – ♀: L = = 0.39 – 0.43 mm; a = 30 – 33; b = 3.7 – 4.1; c = 6.3 – 7.2; V = 51 – 52%. ♂ unknown. (Hungary.) ..... **gracilicaudatus** sp. n.
– Tail 4 – 5 times anal body diameter, more robust 2

2 Amphids 3 head diameters behind anterior body end; tail tip with mucro. – ♀: L = 0.43 mm; a = 21 – 22; b = 3.3 – 3.6; c = 8.6 – 8.7; V = 50 – – 53%. ♂ unknown. (Zaire.) ..... **deconincki** ANDRÁSSY
– Amphids 1.5 – 2 head diameters behind anterior body end; tail tip without mucro. – ♀: L = 0.30 – 0.50 mm; a = 18 – 28; b = 3.5 – 4.4; c = 7 – 10; V = 53 – 60%. ♂: L = 0.33 mm; a = 23; b = 3.9; c = 9.3. (Holland, Belgium, Germany, Austria, Switzerland, Hungary, Czechoslovakia, Rumania, Poland, Great Britain, Denmark, Spain, Italy, Soviet Union [Estonia, Lithuania, Uzbekistan], Japan, Kenia, Brunei, Morocco, Venezuela, New Zealand.) ..... **crassidens** (DE MAN)

Acrobeles canalis sp. n.

(Fig. 4 A – D)

♀: L = 0.83 – 0.86 mm; a = 17 – 18; b = 3.5 – 3.7; c = 11; V = 60 – – 62%; c' = 2.3 – 2.4.

Body comparatively large and stout, hardly curved ventrally. Cuticle single, thin, 1.5 – 1.8 μm, with broad and flat annules. Each annule bearing two rows of fine dots. Annules 4 – 4.7 μm wide on mid-body; their total number on the holotype female is 202 (from head to proximal base of oesophagus 53, from head to vulva 119, from head to anus 183 annules). Lateral field 6.5 – 7 um wide, 1/7 of body diameter, consisting of three longitudinal lines; the inner one is somewhat thicker than the marginal ones, and the latter are slightly crenate. The lateral field begins at the anterior third of procorpus and terminates on tail tip. A very characteristic feature is that on each side of the body a very prominent zigzag-shaped canal runs in the lateral chord (below the lateral field). This canal originates at the middle of oesophagus and reaches to the beginning of tail.

Head 20 μm wide, body at posterior end of oesophagus 2.3 times as wide as head. Labial probolae 17 – 18 μm long, bifurcate to the half of their length; each

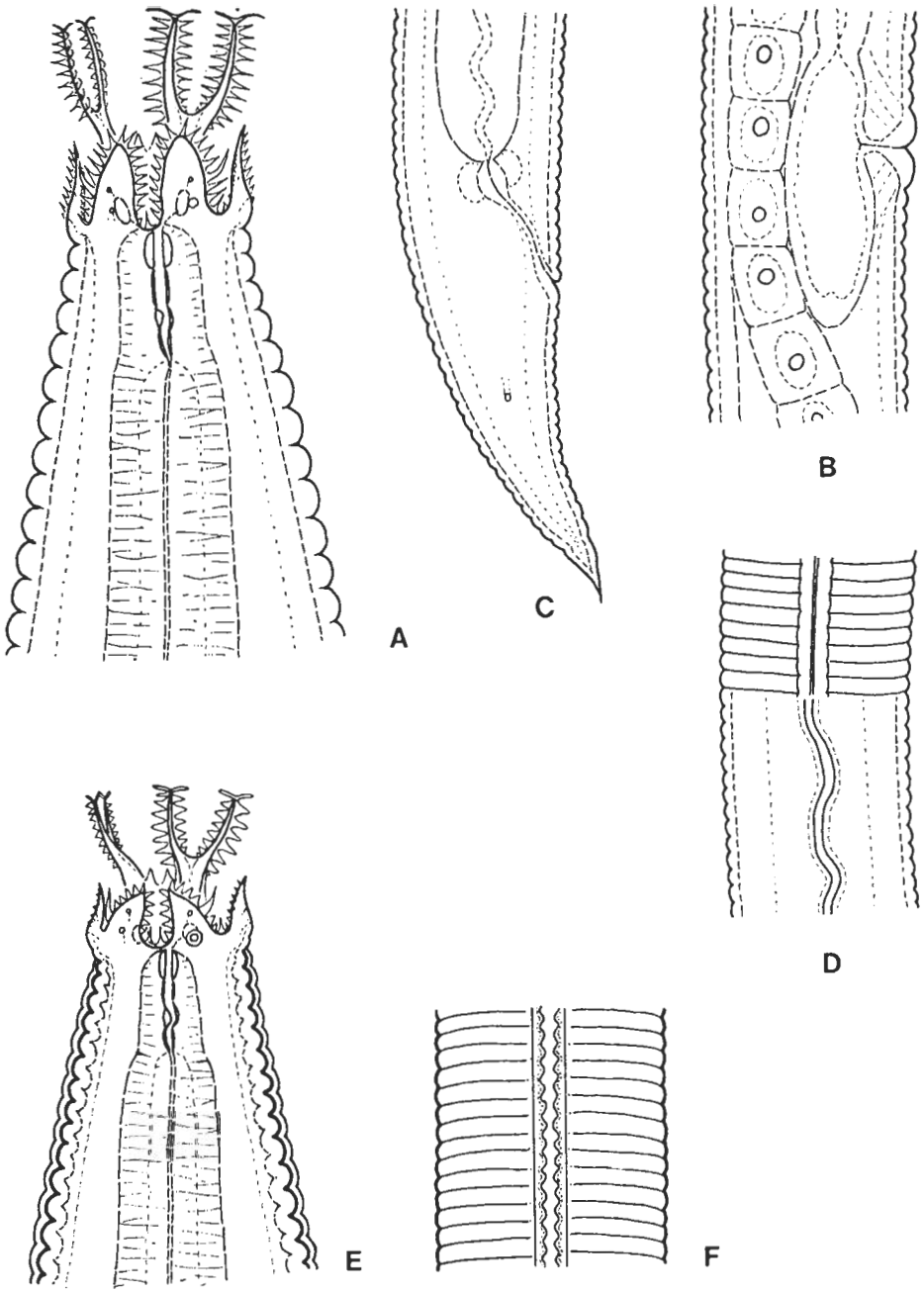

Fig. 4. A – D: *Acrobeles canalis* sp. n. A: anterior end (1200×); B: vulval region (600×); C: female tail (600×); D: a part of mid-body showing the lateral field (up) and the lateral canal (down). – E – F: *Seleborca complexa* (THORNE, 1925) comb. n. E: anterior end (1200×); F: a part of body with the lateral field

prong fringed with long and thin, sharply acute tines, 8–10 in number on each border. Terminal spurs very thin. Cephalic probolae nearly half as long as labial ones, with thin fringes. Amphids circular, located on the lateral cephalic probolae.

Stoma 16–17 μm long. Cheilorhabdions oblong, refractive, prorhabdions bacilliform, cuticularized, other rhabdions small. Oesophagus 230 μm long, distance between oesophagus end and vulva 1.3 times longer than oesophagus. Procorpus practically cylindrical, isthmus about as long as terminal bulb; the latter 36 μm long. Prerectum well separate, 80 μm long, 2.5 times anal body diameter. Excretory pore on the 36th annule, 145 μm from anterior end, or in 63% of oesophagus length, respectively.

Vagina short, 1/4 of body width. Postvulval uterine sac about equal in length with vulval body diameter. Ovary long, reaching the prerectum. Distance between vulva and anus 3.2 times as long as tail.

Tail conoid, with acute terminus, 75–78 μm long, 2.3–2.4 times anal body diameter, and 9% of total body length, respectively. On the ventral side of tail 18–19 cuticular annules may be counted. Phasmids situated in 34–38% of tail length.

Male was not found.

Holotype: female on slide No. H–10142 in the collection of the author.

Type locality: Fülöpháza, Kiskunság National Park in Hungary, sandy, grassy soil, April 1978.

The new species can be distinguished from every other representative of the genus *Acrobeles* by the presence of subcuticular lateral canals. The structure of head and the width of cuticular annules serve also as good diagnostic characters for *Acrobeles canalis* sp. n.

As pointed out by Heyns (1969) and found also by me in course of studying my *Acrobeles* collection as well as the corresponding literature, the species of this genus may be divided in two distinct groups. The one group is characterized by a single cuticle and a lateral field consisting of two or three lines, whilst the other one is marked by a conspicuously double cuticle and a lateral field bearing two simple outer and two strongly waved inner incisures. In my opinion, these two groups represent also separate genera, namely the old genus *Acrobeles* and a new genus, for which I propose the name *Seleborca* gen. n.

Below, I give the definition of each genus with enumerating the species.

Acrobeles Linstow, 1877

Cephalobidae, Acrobelinae. Body length between 0.3 and 1.1 mm. Cuticle single (Fig. 4A), often ornamented with minute dots, annules simple or, rarely, divided into blocks by longitudinal striae. Lateral field simple, with two or three incisures, of which the marginal ones straight or slightly crenate. Head with two kinds of appendages: labial probolae long, bifurcate, fringed with thin and acute tines and terminated in fine spurs. Cephalic probolae more or less triangular, also with fringes. Amphids circular, well visible. Stoma consisting of the usual five elements (rhabdions); cheilorhabdions refractive. Oesophageal procorpus generally cylindrical, terminal bulb strong. Location of excretory pore varying between 1/4 and more than 3/4 of oesophagus length. Ovary anterior with two flexures; postvulval uterine sac present. Males generally with eight pairs of genital papillae. Tail in both sexes conoid, acute, with distinct phasmids.

Type-species: *Acrobeles ciliatus* LINSTOW, 1877.
Soil-inhabiting species occurring in every continent except the Antarctica. Thirteen species may be listed here:

A. annulatus HEYNS & HOGEWIND, 1969

A. bushmanicus HEYNS, 1969

A. canalis sp. n.

A. chelatus THOMAS & ALLEN, 1965

A. ciliatus LINSTOW, 1877
Syn. *Cephalobus ciliatus* (LINSTOW, 1877) DE MAN, 1880
Cephalobus (Acrobeles) ciliatus (LINSTOW, 1877) DE MAN, 1880 (MICOLETZKY, 1922)
Acrobeles sinensis KREIS, 1930
Acrobeles maeneeneus YEATES, 1967 (syn. n.)
Acrobeles singulus HEYNS, 1969 (syn. n.)

A. cylindricus IVANOVA, 1968

A. elaboratus THORNE, 1925
Syn. *Acrobeles kotingotingus* YEATES, 1967 (syn. n.)

A. serricornis THORNE, 1925

A. sheasbyi HEYNS & HOGEWIND, 1969

A. sparsus HEYNS, 1969

A. taraus YEATES, 1967

A. thornei HEYNS, 1963

A. undulatus LOOF, 1964

The following species must be regarded as "species inquirenda":
A. neocephalatus KANNAN, 1961

Key to the species of Acrobeles

1 Annules of cuticle divided into blocks by longitudinal striae 2
– Annules of cuticle simple, not divided into blocks 4

2 Vulva sunken in body contour and surrounded by a flap-like cuticular membrane. – ♀: L = 0.68–0.82 mm; a = 15–24; b = 3.3–4.3; c = 11–12; V = 59–63%. ♂: L = 0.62–0.71 mm; a = 18–21; b = 3.6–4.0; c = = 10–13. (South- and South-West Africa.) ..... **sheasbyi** HEYNS & HOGEWIND
– Vulva not sunken in body contour, without cuticular membrane 3

3 Body 0.7–1.0 mm; annules 4.5–5.5 µm wide. –♀: L = 0.69–0.98 mm; a = 13–25; b = 3.7–4.2; c = 9.7–12; V = 58–65%. ♂: L = 0.76–1.0 mm; a = 16–24; b = 3.8–4.3; c = 9.5–11. (South Africa, United States.) ..... **thornei** HEYNS

– Body 0.5–0.7 mm; annules 3 μm wide. – ♀: L = 0.49–0.65 mm; a = = 14–17; b = 3.3–4.1; c = 9–14; V = 63–67%. ♂ unknown. (Venezuela.) ..... **undulatus** Loof

4 Anterior body region swollen, unusually plump; excretory pore far before the middle of oesophagus; body very small, 0.3 mm. – ♀: L = 0.30–0.33 mm; a = 13–15; b = 2.8–3.6; c = 8–10; V = 56–60%. ♂ unknown. (Hungary, Soviet Union: Uzbekistan, Tadzhikistan.) ..... **cylindricus** Ivanova

– Anterior body region not swollen; excretory pore (when its position known) at the middle of oesophagus length or posterior that 5

5 Lateral field with two incisures and minutely spotted inner area; labial probolae curved inwards .....

– Lateral field with three incisures, not spotted; labial probolae practically straight 8

6 Each annule ornamented with two rows of fine dots. – ♀: L = 0.74 mm; a = 15; b = 4; c = 15; V = 60%. ♂ unknown. (Spain, Hungary, United States: Utah.) ..... **elaboratus** Thorne

– Annules without visible dots 7

7 Cephalic probolae long and slender, approaching the labial probolae in length. – ♀: L = 0.61 mm; a = 15; b = 4.2; c = 13; V = 63%. ♂ unknown. (United States: Utah; Soviet Union: Russia, Uzbekistan.) ..... **serricornis** Thorne

– Cephalic probolae of usual form, about half as long as labial probolae. – ♀: L = 0.38–0.65 mm; a = 14–19; b = 3.0–4.2; c = 8–10; V = 56–63%. ♂: L = 0.39–0.59 mm; a = 15–21; b = 3.0–3.7; c = 9–13. (Europe: Holland, GFR, GDR, Austria, Hungary, Italy, Great Britain, Sweden, Bulgaria; Soviet Union: Russia, Ukraine, Latvia, Lithuania, Estonia, Belorussia, Georgia, Turkmenia, Azerbaizhan, Tadzhikistan, Uzbekistan, Kazakhstan, Kirghizia, Far East; Asia: Mongolia; Africa: Algeria, Zaire, South-Africa; America: Brasil, Venezuela; Australia: New Zealand.) ..... **ciliatus** Linstow

8 Lateral chord with a sclerotized, strongly waved canal. – ♀: L = 0.83– –0.86 mm; a = 17–18; b = 3.5–3.7; c = 11; V = 60–62%. ♂ unknown. (Hungary.) ..... **canalis** sp. n.

– Lateral chord without such a canal 9

9 Each arm of labial probolae armed with three terminal spurs forming a claw. – ♀: L = 0.56–0.75 mm; a = 18–23; b = 3.5–4.1; c = 11–14; V = = 60–63%. ♂: L = 0.61–0.67 mm; a = 20–22; b = 3.8–4.0; c = 10–12. (Australia: New South Wales.) ..... **chelatus** Thomas & Allen

– Each arm of labial probolae armed with the usual two terminal spurs ...10

10 Annules exceptionally broad, 6–7 μm on mid-body; head with three marginal supplementary probolae. – ♀: L = 1.05–1.07 mm; a = 17–28; b = = 4.5–4.7; c = 14–15; V = 63–66%. ♂: L = 0.89–1.0 mm; a = 26–29; b = 3.9–4.5; c = 11–12. (South- and South-West Africa.) ..... **annulatus** Heyns & Hogewind

– Annules not so broad, 2.5 to 4 μm on mid-body; head without marginal supplementary probolae 11

11 Anterior 12–18 cuticular annules corrugated; tail short and stout, only one-and-a-half times anal body diameter. – ♀: L = 0.68–0.75 mm; a = 15–17; b = 3.7; c = 15–16; V = 63–64%. ♂: L = 0.60–0.73 mm; a = 15–22; b = 3.4–3.9; c = 12–16. (New Zealand.) ..... **taraus** YEATES

– Anterior cuticular annules not corrugated; tail longer, 2–3 times anal body diameter 12

12 Body 0.5–0.6 mm long; labial probolae with 5–7 pairs of fringes on each sprong. – ♀: L = 0.51–0.58 mm; a = 14–19; b = 3.5–3.8; c = 10–13; V = 60–62%. ♂: L = 0.55–0.56 mm; a = 19–21; b = 3.5–3.8; c = 11–13. (South- and South-West Africa.) ..... **bushmanicus** HEYNS

– Body 0.7–0.8 mm long; labial probolae with 8–10 pairs of fringes on each sprong. – ♀: L = 0.71–0.85 mm; a = 14–24; b = 3.9–4.1; c = 8.6–14; V = 60–66%. ♂ unknown. (South Africa.) ..... **sparsus** HEYNS

Seleborca gen. n.*

Cephalobidae, Acrobelinae. Body length between 0.4 and 0.9 mm. Cuticle double: the outer layer thinner and showing faint annules, the inner layer thicker, heavily annulated and more strongly sclerotized than the former (Fig. 4 E); annules occasionally with minute dots but never divided into blocks by longitudinal striae. Lateral field consisting of two simple outer lines and two corrugated or waved inner lines. In head structure and other characteristics very similar to the genus *Acrobeles*.

Type-species: *Acrobeles complexus* THORNE, 1925 = *Seleborca complexa* (THORNE, 1925) comb. n.

Terricolous animals with world-wide distribution.

Ten species belong to the genus:

S. cephalata (COBB, 1901) comb. n.
Syn. *Cephalobus cephalatus* COBB, 1901
Acrobeles cephalatus (COBB, 1901) THORNE, 1925

S. complexa (THORNE, 1925) comb. n.
Syn. *Acrobeles complexus* THORNE, 1925

S. ctenocephala (THORNE, 1925) comb. n.
Syn. *Acrobeles ctenocephalus* THORNE, 1925

S. dimorpha (HEYNS & HOGEWIND, 1969) comb. n.
Syn. *Acrobeles dimorphus* HEYNS & HOGEWIND, 1969

S. ensicaudata (THOMAS & ALLEN, 1965) comb. n.

S. mariannae (ANDRÁSSY, 1968) comb. n.
Syn. *Acrobeles mariannae* ANDRÁSSY, 1968
Acrobeles capensis HEYNS, 1969 (syn. n.)

* „*Seleborca*" is an inverse form of the word „*Acrobeles*" and feminin in gender.

S. ornata (THORNE, 1925) comb. n.
Syn. *Acrobeles ornatus* THORNE, 1925

S. raoi (KANNAN, 1961) comb. n.
Syn. *Acrobeles raoi* KANNAN, 1961

S. recurva (HEYNS, 1969) comb. n.
Syn. *Acrobeles recurvus* HEYNS, 1969

S. timmi (CHATURVEDI & KHERA, 1979) comb. n.
Syn. *Acrobeles timmi* CHATURVEDI & KHERA, 1979

Key to the species of Seleborca

1 Tail comparatively long, 4–6 times anal body diameter. 2
– Tail shorter, 1.5–3 times anal body diameter 3

2 Tail in its posterior 2/3 very slender, ensiform; excretory pore far before the middle of oesophagus lenght. – ♀: L = 0.62–0.68 mm; a = 16–17; b = = 3.6–4.1; c = 5.3–6.0; V = 54–58%. ♂ unknown. (United States: Florida.) ..... **ensicaudata** (THOMAS & ALLEN)
– Tail uniformly conoid; excretory pore behind the middle of oesophagus length. – ♀: L = 0.83–0.89 mm; a = 19–25; b = 3.9–4.4; c = 7.8–8.8; V = 53–56%. ♂: L = 0.76–0.83 mm; a = 19–23; b = 3.8–4.2; c = 13– –15. (South- and South–West Africa.) ..... **dimorpha** (HEYNS & HOGEWIND)

3 Tail unusually short, hardly longer than one anal body diameter 4
– Tail two anal body diameters or longer. 5

4 One of the terminal spurs of each labial furca recurved backwards. – ♀: L = 0.80–0.85 mm; a = 15; b = 4.2; c = 17; V = 64%. ♂: L = 0.73 mm; a = 18; b = 4.5; c = 11. (United States: Colorado; Soviet Union: Georgia, Kazakhstan.) ..... **ornata** (THORNE)
– Both terminal spurs of each labial furca directed forwards. – ♀: L = 0.86– –0.95 mm; a = 11–13; b = 3.8–5.6; c = 9.6–12; V = 57%. ♂: L = = 0.8 mm; a = 14; b = 4.5; c = 18. (India.) ..... **raoi** (KANNAN)

5 Excretory pore level with the anterior part of oesophagus; small species, 0.4–0.5 mm 6
– Excretory pore level with the posterior part of oesophagus; larger species, more than 0.5 (to 0.9) mm 7

6 Labial and cephalic probolae with long and acute tines; head distinctly wider than neck region. – ♀: L = 0.37–0.52 mm; a = 13–19; b = 3.1–3.5; c = 10–13; V = 58–62%. ♂ unknown. (South Africa, Paraguay.) ..... **mariannae** (ANDRÁSSY)
– Labial and cephalic probolae with extremely minute tines; head not separate, as wide as neck region. – ♀: L = 0.4 mm; a = 17; b = 4; c = 10; V = = 58%. ♂: L = 0.4 mm; a = 18: b = 4; c = 25. (Australia: New South Wales.) ..... **cephalata** (COBB)

7 Termini of labial furcas recurved toward the oral aperture; annules of cuticle with punctation. – ♀: L = 0.63–0.65 mm; a = 17–23; b = 3.9–4.0; c = 8.7–10.5; V = 58%. ♂: L = 0.62–0.66 mm; a = 23–24; b = 3.8; c = 11–14. (South Africa.) ..... **recurva** (HEYNS)
– Termini of labial furcas straight; annules of cuticle without punctation 8

8 Tail 2 anal body diameters, phasmids opposite the anus. – ♀: L = 0.5 mm; a = 13; b = 3.6; c = 13; V = 64%. ♂: L = 0.59 mm; a = 17; b = 3.4; c = 12.5. (United States: California, Colorado, Utah; Soviet Union: Russia, Moldavia, Georgia, Uzbekistan, Kazakhstan.) ..... **ctenocephala** (THORNE)
– Tail 3–4 anal body diameters, phasmids far behind the anus 9

9 Posterior uterine branch distinctly longer (to twice) than corresponding body diameter; body 0.6–0.8 mm long. – ♀: L = 0.59–0.83 mm; a = 13–21; b = 3.5–4.3; c = 9–12; V = 56–60%. ♂: L = 0.58–0.85 mm; a = 16–23; b = 3.5–4.3; c = 12–15. (Holland, Hungary, Czechoslovakia, Italy, Turkey, Soviet Union [Russia, Moldavia, Uzbekistan], Mongolia, South Africa, United States [California, Colorado, Idaho, Utah], Cuba, Venezuela.) **complexa** (THORNE)
– Posterior uterine branch much shorter than corresponding body diameter; body 0.5–0.6 mm long. – ♀: L = 0.49–0.62 mm; a = 17–18; b = 3.5–4.1; c = 9–11; V = 57–59%. ♂: L = 0.51–0.63 mm; a = 16–20; b = 4.1–4.2; c = 12–15. (India.) ..... **timmi** (CHATURVEDI & KHERA)

Caenorhabditis cervi sp. n.
(Fig. 5A–E and 6A–B)

♀: L = 0.56–0.68 mm; a = 22–25; b = 4.5–4.7; c = 8.3–9.0; V = 54–56%; c' = 5.0–5.4.

♂: L = 0.57–0.60 mm; a = 22–26; b = 4.4–5.0; c = 22–25.

Body straight or slightly bent ventrally. Cuticle very thin, only about 0.5 µm at mid-body, smooth, or exceedingly finely striated on both ends of body. Body width in the middle region 24–27 µm (♀).

Head 7 µm wide, not set off, lips hardly separate, low with minute papillae. Body at posterior end of oesophagus 3.3–3.5 times as wide as head. Amphids inconspicuous, slit-like, located on the lateral lips.

Mouth cavity 21–23 (♀) or 18–20 (♂) µm long, about 3 times head diameter, 1/6–1/7 of entire length of oesophagus, respectively. Cheilostom not cuticularized, promesostom tubular, surrounded by a thin oesophageal collar to about 60% of its length. Metastom isoglottoid, bearing two very fine setose denticles on each swelling. Oesophagus in ♀ 122–146, in ♂ 113–133 µm long; anterior portion (from head to base of medial bulb) 55–58% of its length. Medial bulb oblong, not too strong, basal bulb spherical-oval, well developed. Excretory pore level with posterior bulb or isthmus. Rectum nearly as long as anal diameter.

Distance between oesophagus and vulva 1.5–1.6 times as long as oesophagus, that between vulva and anus 2.8–3 times as long as tail. Vulva a little protruding, vagina thin, 1/3 of corresponding body diameter. Female gonads paired, anterior branch 5.7–6.5, posterior branch 5.1–5.8 times body diameter, or 25 and 22–23% of body length, respectively. One or two eggs in the uteri; 47×19 µm. Oviparous animal.

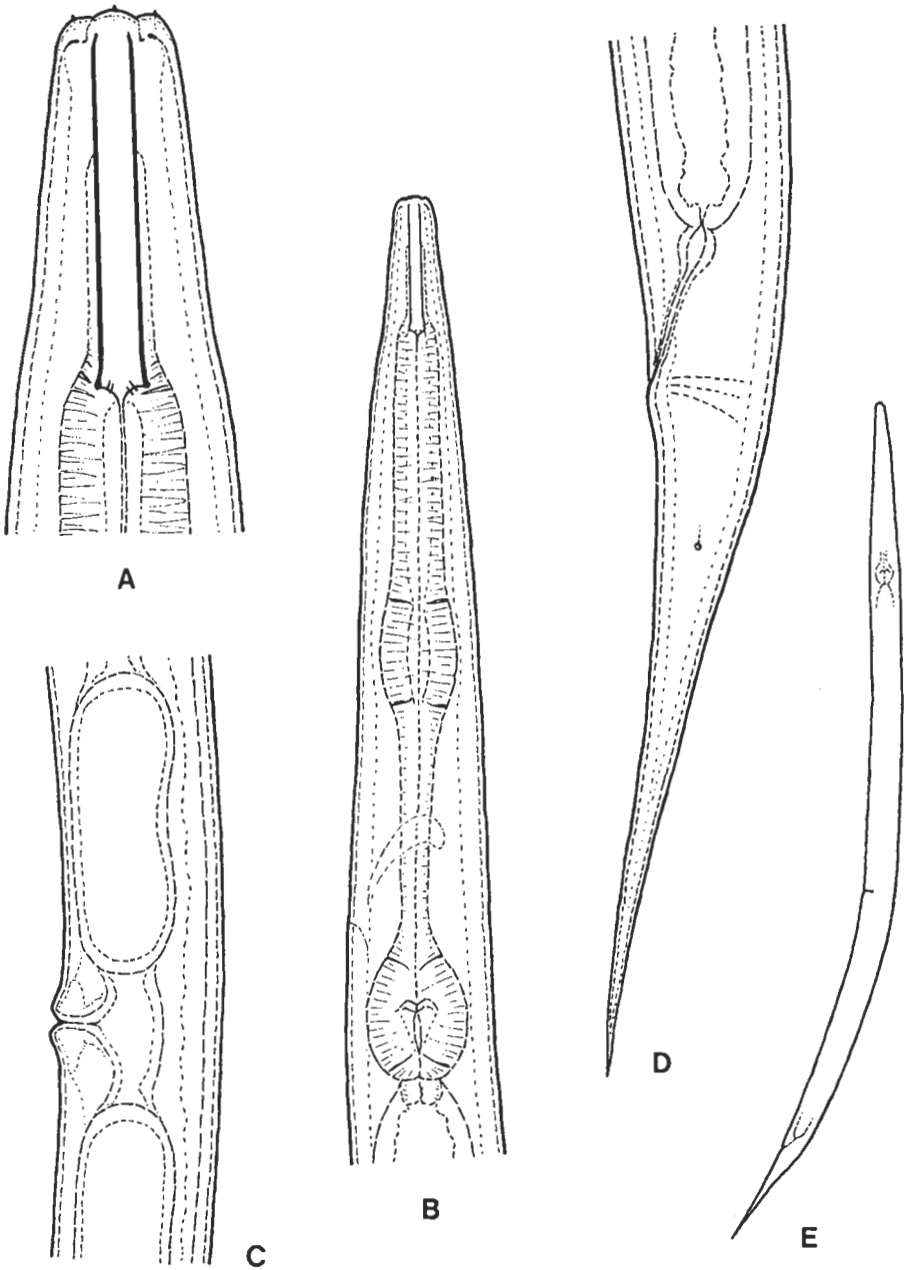

Fig. 5. *Caenorhabditis cervi* sp. n. A: anterior end (2500×); B: oesophageal region (800×); C: vulva and eggs (800×); D: female tail (1200×) E: entire female (170×)

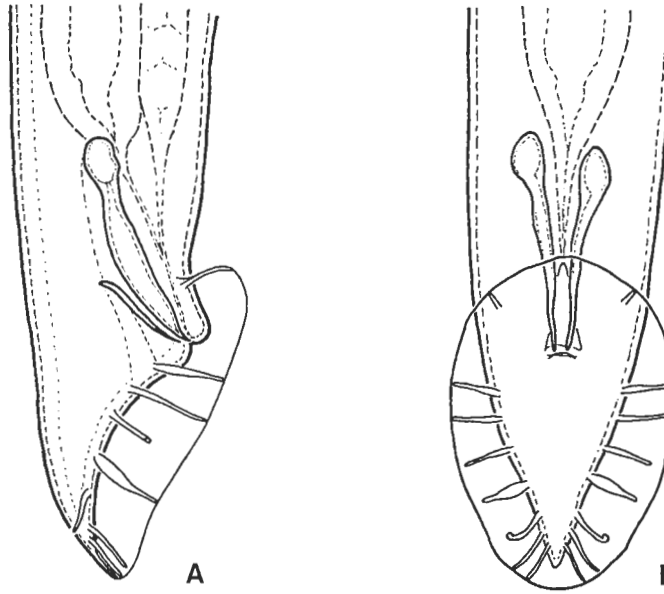

Fig. 6. *Caenorhabditis cervi* sp. n. A: posterior body end of male from lateral view (1200×); B: the same from medial view (1200×)

Female tail 68 – 76 μm long, 5 – 5.4 times anal body diameter, and 11 – 12% of body length, conoid, straight. Phasmids small, at about 1.5 anal diameters behind anus.

Male tail conical, slightly bent ventrally. Spicula free, 22 – 24 μm long, anteriorly spoon-like; left spiculum occasionally somewhat shorter than the right one. Gubernaculum simple, 9 – 10 μm long. Bursa peloderan, regularly oval (not cardioid), anteriorly closed, with smooth or very finely waved margin. Its length 33 – 35 μm, width 23 – 24 μm. Eight pairs of bursal papillae present: 1 + 4 + 3 pairs, of which the first pair is situated just on the anterior margin of the bursa, the other lying postcloacal. The group of the 2nd to 5th papillae is fairly loose, papillae 6 – 8 are close one another. The 5th papilla, on both side, is the thickest.

Holotype: Male on slide No. H – 9854 in the collection of the author.

Type locality: Dömös in the Pilis Mountains, Hungary, straw litter in a deer feeder, February 1983.

Caenorhabditis cervi sp. n. is unique among the eight known species of the genus in three characteristics: *1)* the mouth cavity is comparatively long, 3 head diameters, while in the other species it is shorter than two head widths; *2)* the bursa has only 8 pairs of papillae, i. e. the 2nd preanal pair, being always present in other species, is completely lacking here; *3)* the body is smaller (♀ to 0.7 mm) than in the other representatives of the genus (♀ 0.8 – 1.8 mm).

Hoplorhynchus gen. n.

Hoplolaimidae, Rotylenchinae. Body straight. Cuticle distinctly annulated. Lateral fields broad, each bearing six longitudinal furrows, without annulation. Head hemispherical, possessing fine transverse striae and a heavy cephalic framework. Amphids minute. Spear strong, with rounded basal knobs. Orifice of dorsal oesophageal gland close to spear base. Medial bulb with central valve, terminal bulb dorsally lobed. Female gonads paired, ovaries outstretched. Vulva without epiptygma. Tail cylindrical with rounded tip; annulation encircling tail terminus. Phasmids small, behind middle of tail. Male unknown.

Type and only species: *Hoplorhynchus riparius* sp. n.

On the basis of the head shape, the strong cephalic framework, the spear shape, the lobed oesophagus, the paired gonads and the conspicuous phasmids the new genus belongs to the family Hoplolaimidae, and, on the basis of the high head, the short oesophageal lobe and the small phasmids to the subfamily Rotylenchinae. It shows however three characteristics in which it differs from every other representative of the subfamily, and even of the family: *1)* the lateral fields bear not four but six incisures, *2)* the tail is comparatively long and cylindrical and *3)* the phasmids are located in the posterior half of the tail. In shape of the tail and structure of the lateral fields *Hoplorhynchus* gen. n. resembles the genera of the family Tylenchorhynchidae but in construction of the head and oesophagus it is a typical representative of the Hoplolaimidae. It is in many respects similar to *Rotylenchus* FILIPJEV, 1936 but differs from it by the three peculiarities mentioned above.

Hoplorhynchus riparius sp. n.
(Fig. 7A – D)

♀: L = 0.83 – 0.96 mm; a = 27 – 34; b = 4.5 – 5.0; c = 16 – 17; V = 57 – – 58%; c' = 2.4 – 2.7.

Body fairly plump, 24 – 31 μm wide in the middle, almost straight. Cuticle 1.2 – 1.5 μm thick, finely annulated; annules 1.5 – 1.9 μm wide on the mid-body. Lateral fields 8 – 9 μm wide, about 1/3 of body diameter, each with six longitudinal incisures but without transverse striae or annules.

Head hemispherical, 9.5 – 10 μm wide at base, bearing 5 – 6 thin annules; at posterior end of oesophagus body 2.6 – 2.8 times as wide as head. Cephalic framework well developed, strong, hoplolaimoid. Amphids minute, indistinct. Buccal spear fairly robust, 21 – 22 μm long, 1.1 – 1,3 times longer than head diameter. Metenchium 50 – 52% of spear length. Basal knobs rounded, about 5 μm wide. Orifice of dorsal oesophageal gland not far (1.5 times the knob width) from spear base.

Medial bulb of oesophagus strong, oval, with central valve. Posterior half of oesophagus consisting of a shorter isthmus and a longer glandular part; basal lobe overlapping the intestine dorsally; overlapping part 12 – 15 μm long. Glandular nuclei conspicuous. Excretory pore level with posterior bulb or situated somewhat before it. Oesophagus 182 – 190 μm long, anterior portion (from head to base of medial bulb) 46 – 48% of its length. Hemizonid and deirids 3 – 4 annules before excretory opening. Rectum somewhat shorter than anal body diameter.

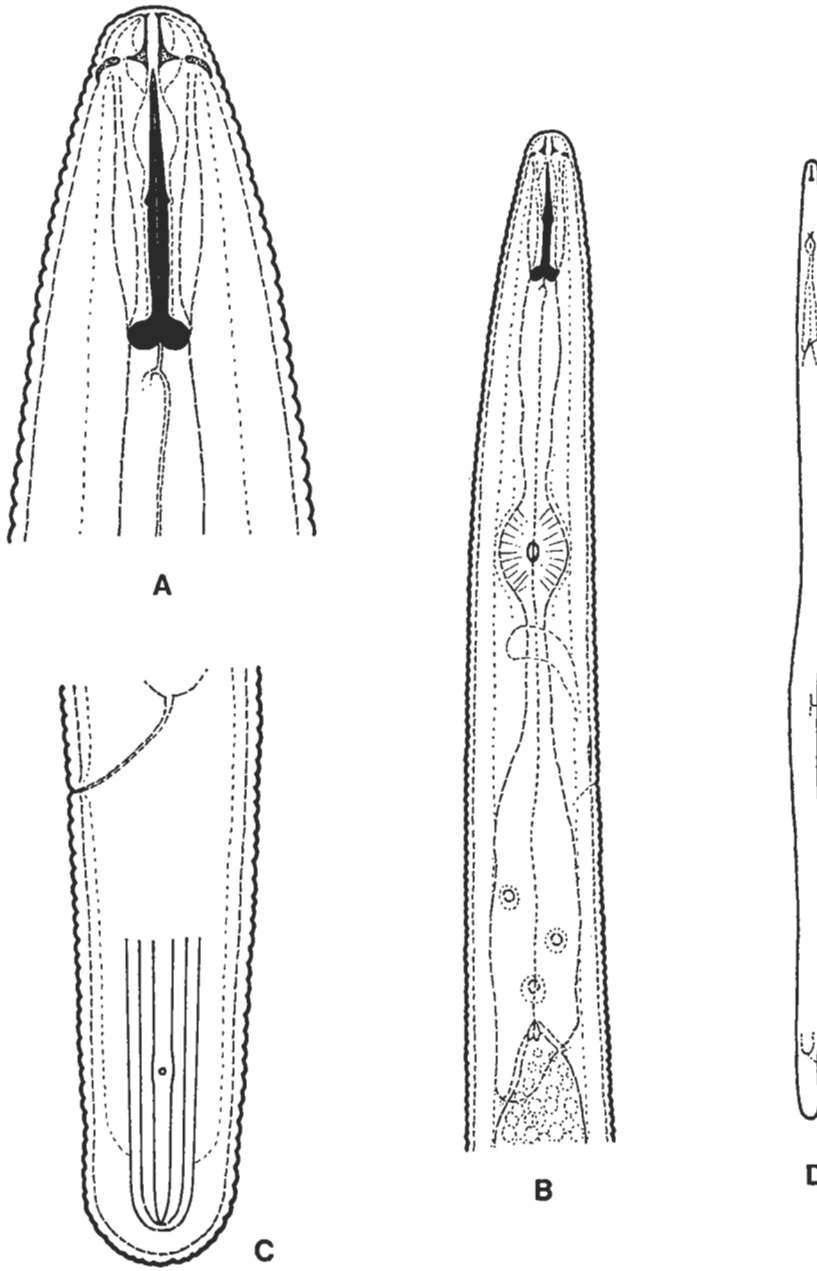

Fig. 7. *Hoplorhynchus riparius* gen. n., sp. n. A: anterior end (1600×); B: oesophageal region (600×); C: female tail (1200×); D: entire female

Distance between oesophagus end and vulva 1.6 – 1.8 times as long as oesophagus, that between vulva and anus 5.7 – 6.4 times as long as tail. Vulva transverse, vagina half as long as body width. Gonads paired, long. Spermatheca comparatively small, rounded, packed with very small (1 μm) globular spermatozoa.

Tail cylindrical, 48 – 57 μm long, 2.4 – 2.7 times as long as anal body diameter, bluntly rounded on its tip, with 32 – 37 cuticular annules. Annulation encircling tail terminus. Cuticle strikingly thickened (7 – 9 μm) on tail end. Phasmids small but well visible, in 59 – 64% of tail length.

Male was not found.

Holotype: Female on slide No. H – 9709.

Type locality: Sződliget, Hungary, sandy soil in the inundation area of the Danube River, February 1983.

Ogma danubiale sp. n.

(Fig. 8A – D)

♀: L = 0.47 – 0.49 mm; a = 10 – 11; b = 3.4 – 3.6; c = 11 – 13; V = 84 – – 86%.

Body robust, straight or slightly bent ventrally, 44 – 47 μm wide. Consisting of 58 – 60 annules. Annules strong, 8 – 9 μm broad in mid-body region, bearing triangular, uni-tipped scales or appendages arranged in 12 longitudinal rows on the greatest part of body. The number of scale rows decreases to 9 – 11 on the both ends of the body. Scales directed backward, their tips rounded; they are of the same shape on the whole body except the anterior end where they are shorter and more numerous, and the posterior end where they become narrower. Distance between two scales of the same mid-body annule 12 – 14 μm.

Head consisting of two annules directed outward to slightly forward, all other body rings are directed backward. First head annule 16 μm wide, the second one a little narrower. Third annule (the first somatic annule) 23 – 24 μm wide. Margins of cephalic annules weakly waved. Submedial lobes small.

Spear strong, 90 – 95 μm long, 5.5 – 6 times as long as head diameter, 19 – 21% of entire length of body. Metenchium 82 – 83% of spear length. Basal knobs 7 μm wide, in the 11th to 13th somatic annule. Medial bulb heavy, oval, as long as isthmus and basal bulb together, or a little longer.

Vulva located in the 46th to 48th annule counted from head end, or, in the 13th annule counted from tail end. Postvulval body region 66 – 76 μm long, conical. Anus rather indistinct, located 7 – 8 annules before tail tip.

Male and larval forms unknown.

Holotype: Female on slide No. 9713 in the collection of the author.

Type locality: Sződliget, Hungary, sandy soil in the inundation area of the Danube, February 1983.

There are two species of the genus *Ogma* SOUTHERN, 1914 which possess 12 longitudinal rows of cuticular scales: *O. zernovi* KIRJANOVA, 1948 and *O. squamiferum* (HEYNS, 1970) ANDRÁSSY, 1979. The new species can be distinguished from them in having fewer body annules (66 annules in *zernovi*, 66 – 71 annules in *squamiferum*), vulva located farer from the tail end (on the 9th annule in *zernovi*, and on the 8th to 10th annule in *squamiferum*), and postvulvar body

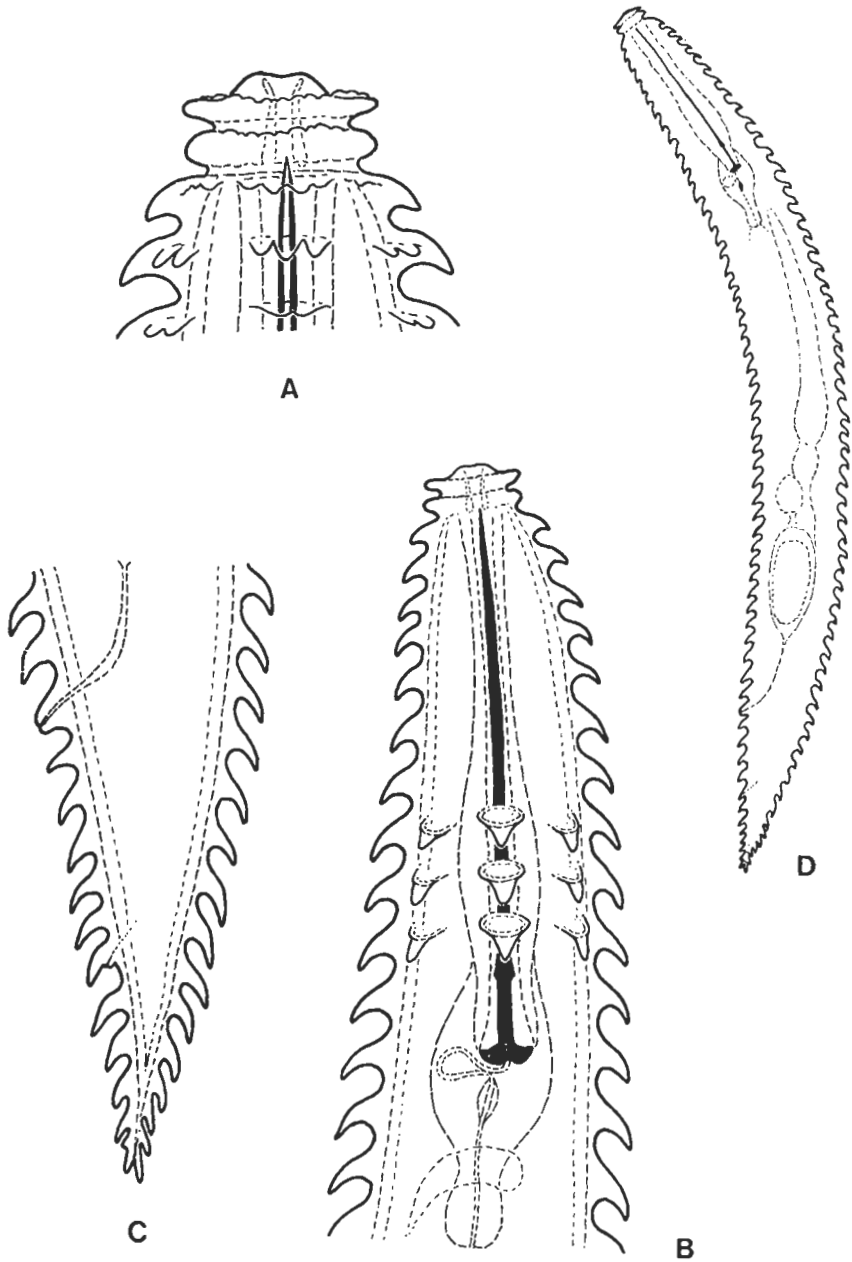

Fig. 8. *Ogma danubiale* sp. n. A: anterior end (1600×); B: oesophageal region (800×); C: posterior end of female (800×); D: entire female (250×)

region being more slender and regularly conical. Besides, it can be separated from *zernovi* by the broad cephalic annules, and from *squamiferum* by the smaller body (*squamiferum* 0.62 – 0.70 mm long), the head annules being almost equal in width, the shorter spear (102 – 108 μm in *squamiferum*), and the more sharply pointed cuticular scales.

Ogma castellanum sp. n.

(Fig. 9A – D)

♀: L = 0.43 – 0.46 mm; a = 8.8 – 9.6; b = 3.5 – 4.0; c = 12 – 14; V = = 84 – 87%.

Body robust, straight or a little bent ventrally, 46 – 49 μm wide (including scales), consisting of 60 – 66 annules. Annules 7.9 – 9 μm wide in mid-body region, bearing triangular or spine-shaped scales arranged in 8 longitudinal rows. Scales uni-tipped and directed backward; they become narrower on the posterior end of body. Distance between each scale of the same body annule 18 – 24 μm.

Head composed of two annules, of which the first annule is wider than the second. First annule 16 – 19 μm, second annule 14 – 15 μm, third annule (first somatic annule) 21 – 26 μm wide. Both head annules directed forward, the others backward. First cephalic annule having 25 – 30 fringes, second annule waved or finely tubercled on its margin. Submedial lobes distinct.

Spear 75 – 82 μm long, 4 – 5 times head diameter, 17 – 19% of body length. Metenchium 81 – 86% of spear length. Basal knobs 8 μm wide, pointed, located in the 11th to 13th somatic annule. Medial bulb oval, mostly longer than isthmus and basal bulb together. Excretory pore 128 – 161 μm posterior to head end, located on the 20th to 23rd annule, in 30 – 35% of body length, respectively. Oesophagus ending in the 17th to 20th somatic annule.

Vulva conical, closed, on the 50th to 53rd annule, or on the 12th to 15th annule from tail end. Postvulval body portion 56 – 75 μm long. Gonad unusually long, reaching to the oesophagus. Egg 56 × 74 μm long. Anus 8 – 9 annules before tail tip. Tail 33 – 36 μm long.

Juvenile (last stage): Rather different from female. Body consisting of 69 annules and bearing short scales arranged in 10 longitudinal rows. A very thin sheath surrounds the annules. Head annules equally wide; first head annule without fringes, only with fine tubercles. Spear 63 μm long.

Male not found.

Holotype: Female on slide No. H – 9885 in the collection of the author.

Type locality: Zemplén Mountains in Hungary, ruins of the castle Füzér, grassy soil on basalt rocks, April 1983.

Ogma castellanum sp. n. can easily be distinguished from every known species of the genus by its first cephalic annule ornamented with conspicuous fringes or appendages. Of the species having 8 longitudinal rows of scales only *O. chrisbarnardi* (Heyns, 1970) Andrássy, 1979 shows a similar head shape (the 1st head annule is distinctly wider than the 2nd). The new species differs from *chrisbarnardi* in having cephalic fringes, cuticular scales not becoming longer on posterior body end, a longer body and a longer spear, and in the vulva being situated farther from body end.

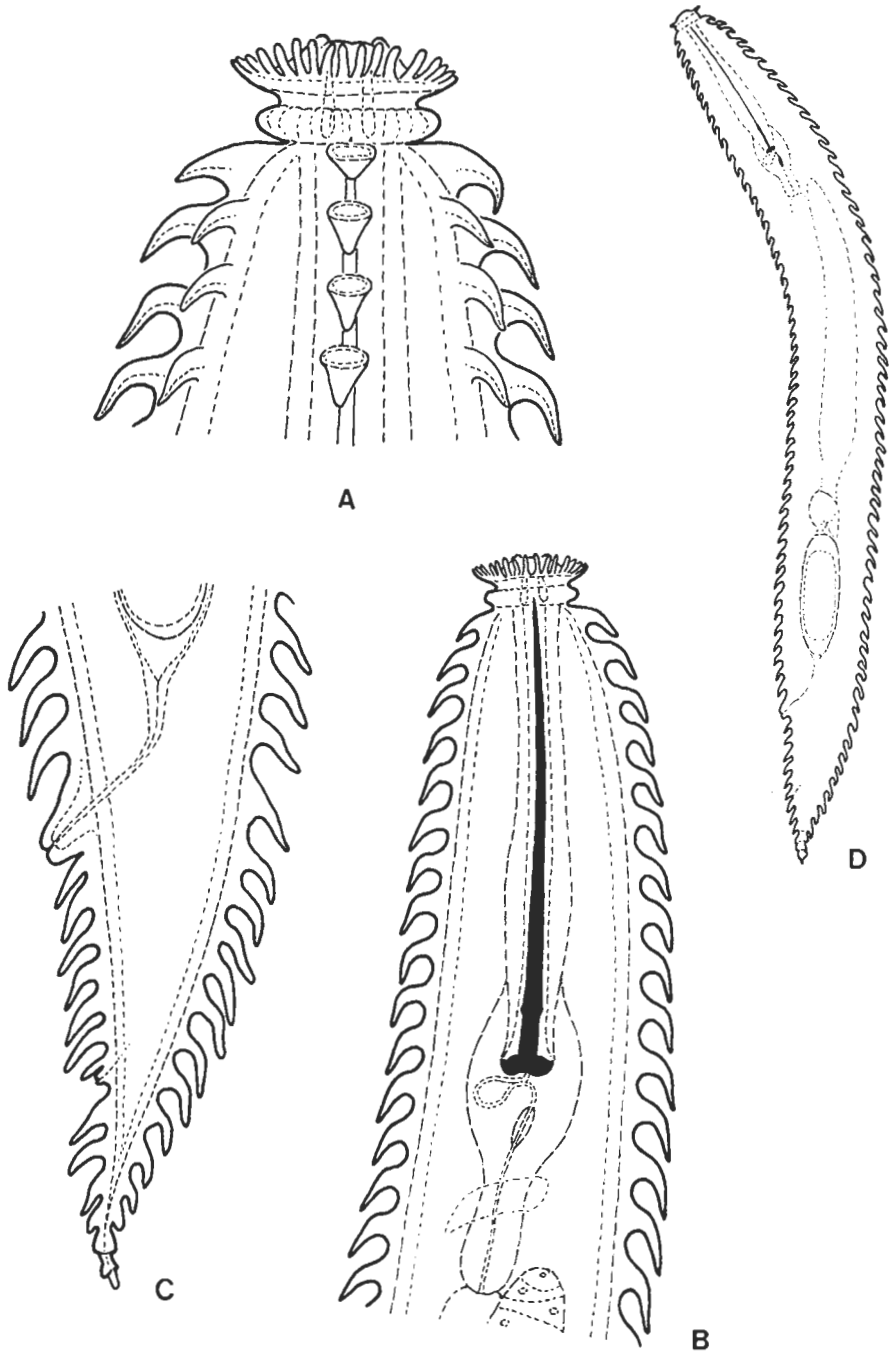

Fig. 9. *Ogma castellanum* sp. n. A: anterior end (1600×); B: oesophageal region (800×); C: posterior end of female (800×); D: entire female (250×)

Trischistoma gracile sp. n.

(Fig. 10A–G)

♀: L = 1.06–1.10 mm; a = 49–53; b = 4.9–5.3; c = 12.2–13.3; V = = 76–78%; c' = 5.0–5.5

Cuticle smooth, very thin. Head at level of the longer setae 10–11 μm wide; body at posterior end of oesophagus 1.6–1.7 times wider than head. Cephalic setae arranged in two circles: anterior ones 6 in number and 6–6.5 μm long (60% of body diameter), posterior ones 4 in number and 5–6 μm long, much thinner than the former ones. Distance between both circles of setae 6.5–7 μm. Amphids small, level with the buccal denticles.

Stoma quite narrow, with minute denticles. Oesophagus cylindrical, 205–216 μm long; distance between oesophagus and vulva 2.8–3.1 times as long as oesophagus. Intestine beginning with wide lumen. Rectum about as long as anal body diameter.

Vulva not cuticularized, vagina half as long as corresponding body diameter, encircled by ring-like muscles. Female gonad unpaired, prevulval. Distance vulva–anus 1.7–2.1 times as long as tail.

Tail 5–5.5 times anal body diameter, 82–86 μm long, very characteristic in shape: on the whole S-shaped, curved first dorsally then ventrally, with a small spinneret on its tip.

Male unknown.

Holotype: Female on slide No. H–9435 in the collection of the author.

Type locality: Fényesfürdő, Hungary, algae from a small pool, May, 1960.

How to distinguish the new species from the other ones – see below in the key.

In 1963 BRZESKI set up a genus, *Tripylina*, for the „*Tripyla*" species possessing unpaired gonads but he synonymized it in 1965 with the genus *Trischistoma* COBB, 1913. Having gone through the descriptions of the *Trischistoma* and *Tripylina* species and the slides presenting such mematodes in my collection as well, I am of the opinion that both genera are still valid.* The monodelphic tripylas may be separated by some characteristics into two definite groups as follows: *1)* in *Trischistoma* the cephalic setae (6) and subcephalic setae (4) are separated into two circles – in *Tripylina* they are all arranged in a single circle (6+4); *2)* in *Trischistoma* the vulva is located far back, at 73–83% of body length – in *Tripylina* it is not so far back, at 56–67% of body length; *3)* in *Trischistoma* the tail is curved dorsally or first dorsally then ventrally – in *Tripylina* it is curved ventrally or first ventrally then dorsally; *4)* in *Trischistoma* the body is more slender (a = 36–84) than in *Tripylina* (a = 18–36).

Below I give an emended definition of each of these genera and also keys to determining the species.

* Recently, THALOLIKHIN (1983) expressed the same opinion.

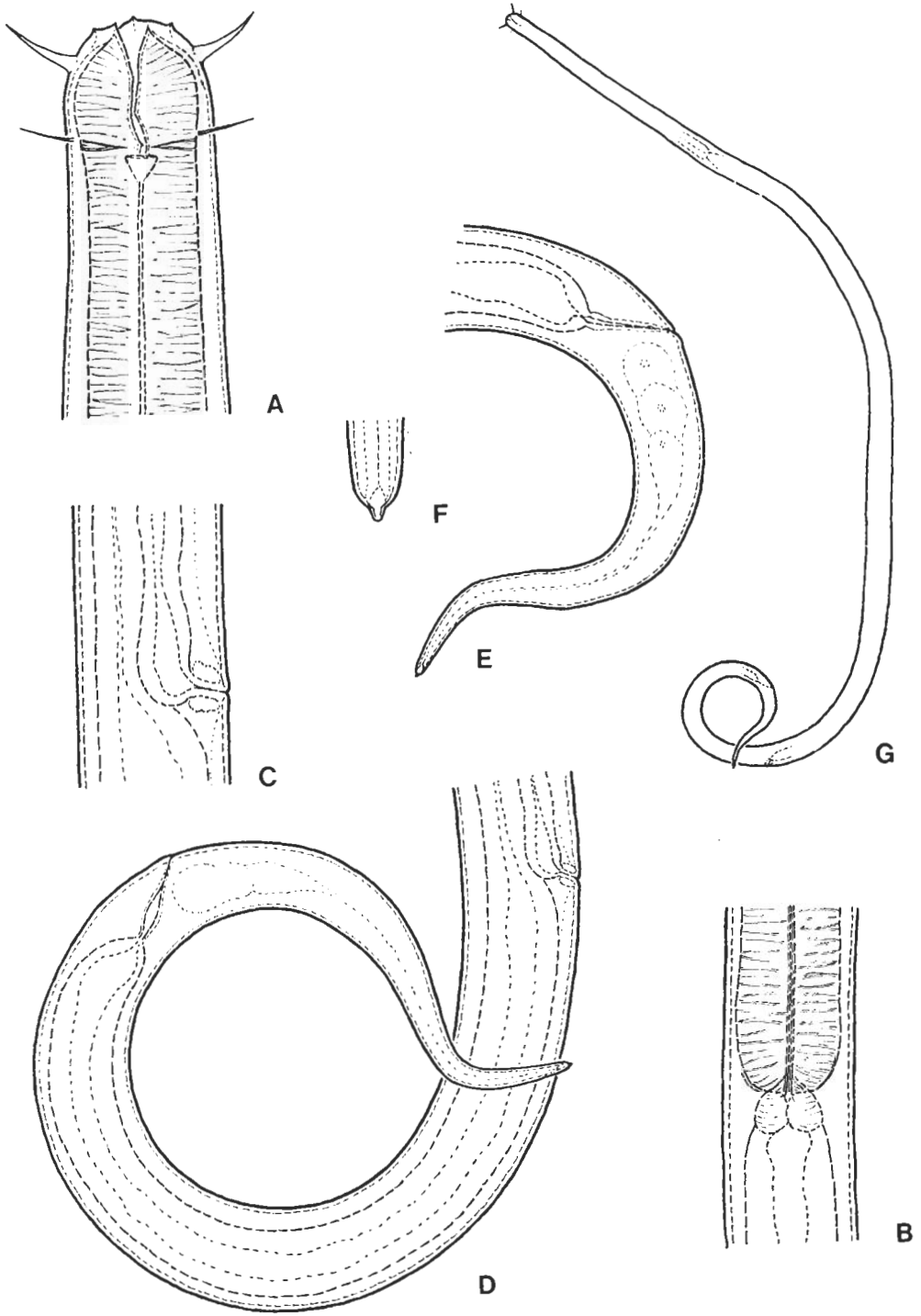

Fig. 10. *Trischistoma gracile* sp. n. A: anterior end (1600×); B: cardial region (1200×); C: vulva (1200×); D: posterior body of female (800×); E: tail of an other female (800×); F: tail tip; G: entire female (170×)

Trischistoma Cobb, 1913

Syn. *Tripyla* (*Trischistoma* Cobb, 1913) Micoletzky, 1925.

Tripylidae. Body 0.6–1.8 mm long (♀) and very slender. Cuticle smooth. Head with 6+4 setae arranged in two circles: 6 longer and stronger cephalic-, 4 shorter and thinner subcephalic setae. Buccal denticles minute. Female gonad prodelphic, with or without posterior uterine sac. Vulva located far back, at 73–83% of body length. Tail 4–6 times as long as anal body diameter, dorsally or first dorsally then ventrally twisted. Males rare or unknown.

Type-species: *Trischistoma pellucidum* Cobb, 1913.

Four species:

T. gracile sp. n.

T. monohystera (de Man, 1880) Schuurmans Stekhoven, 1951

Syn. *Tripyla monohystera* de Man, 1880

Tripyla (Trischistoma) monohystera de Man, 1880 (Micoletzky, 1925)

Tripylina monohystera (de Man, 1880) Brzeski, 1963

T. monohysteroides Altherr, 1963

T. pellucidum Cobb, 1913

Syn. *Tripyla pellucida* (Cobb, 1913) Micoletzky, 1922

Tripyla (Trischistoma) pellucida (Cobb, 1913) Micoletzky, 1922 (Micoletzky, 1925)

Note: The description of *Trischistoma conicaudatum* Schuurmans Stekhoven, 1951 was based on a single juvenile specimen with spiral (?) amphids: species inquirenda.

Key to the species of Trischistoma

1 Body 1 mm or shorter; tail strongly curved, forming a sharp S. 2
– Body 1.5 mm or longer; tail slightly curved, forming a weak S. 3

2 Bigger species, 1.0–1.1 mm; tail 5–5.5 times anal body diameter. – ♀: L = 1.06–1.10 mm; a = 49–53; b = 4.9–5.3; c = 12–13; V = 76–78%. ♂ unknown. (Hungary.) ..... **gracile** sp. n.

– Smaller species, 0.6–0.8 mm; tail 3.5–4 times anal body diameter. – ♀: L = 0.60–0.85 mm; a = 36–43; b = 4.4–4,6; c = 12–14; V = 73–80%. ♂ unknown. (Mexico, Jamaica, Paraguay.) ..... **pellucidum** Cobb

3 Subcephalic setae nearly as long as cephalic setae and lying farther from the latter than the length of a cephalic seta. – ♀: L = 1.4–1.8 mm; a = 45–70; b = 5.0–5.6; c = 12–15; V = 76–80%. ♂: L = 1.38 mm; a = 60; b = 5.4; c = 12. (Holland, both Germanies, Czechoslovakia, Hungary, Switzerland, France, Italy, Yugoslavia, Denmark, Sweden, Soviet Union, China, Sumatra, Congo Republic, United States, Mexico, Jamaica, Argentina.) ..... **monohystera** (de Man)

– Subcephalic setae distinctly shorter than cephalic setae and lying closer to the latter than the length of a cephalic seta. – ♀: L = 1.58–1.84 mm; a = = 69–84; b = 5.0–6.1; c = 13–15; V = 76–83%. ♂: L = 1.42–1.98 mm; a = 53–90; b = 4.0–6.9; c = 11–18. (Argentina.) ..... **monohysteroides** ALTHERR*

Tripylina BRZESKI, 1963

Syn. *Abunema* KHERA, 1971 (syn. n.).

Tripylidae. Body 0.8–1.7 mm long, moderately slender. Cuticle smooth. Both cephalic and subcephalic setae arranged in a single circle, the former much longer and stronger than the latter ones. Buccal denticles comparatively strong. Female gonad prodelphic, without posterior uterine sac. Vulva located in 56–67% of body length. Tail 2.5–4.5 times as long as anal body diameter, ventrally or first ventrally then dorsally curved. Males unknown.

Type-species: *Tripyla arenicola* DE MAN 1880 = *Tripylina arenicola* (DE MAN, 1880) BRZESKI, 1963.

Four species:

T. arenicola (DE MAN, 1880) BRZESKI, 1963
Syn. *Tripyla arenicola* DE MAN, 1880
Tripyla (Trischistoma) arenicola DE MAN. 1880 (SCHNEIDER, 1939)
Trischistoma arenicola (DE MAN, 1880) SCHUURMANS STEKHOVEN, 1951
Tripyla minor COBB, 1893
Abunema indicum KHERA, 1971

T. macroseta (VINCIGUERRA & LA FAUCI, 1978) THALOLIKHIN, 1983
Syn. *Trischistoma macroseta* VINCIGUERRA & LA FAUCI, 1978

T. sheri BRZESKI, 1963
Syn. *Trischistoma sheri* (BRZESKI, 1963) BRZESKI, 1965
Tripyla (Trischistoma) sheri (BRZESKI, 1963) KHERA, 1970
Trischistoma ursulae ARGO & HEYNS, 1973
Tripylina ursulae (ARGO & HEYNS, 1973) THALOLIKHIN, 1983

T. stramenti (YEATES, 1971) THALOLIKHIN, 1983
Syn. *Trischistoma stramenti* YEATES, 1971

Key to the species of Tripylina

1 Body 1.5–1.7 mm long; cephalic setae about as long as 40% of head diameter. – ♀: L = 1.49–1.69 mm; a = 26–30; b = 5.7–6.4; c = 14–19; V = 60–64%. ♂ unknown. (New Zealand.) ..... **stramenti** (YEATES)
– Body smaller than 1.5 mm; cephalic setae about as long as 60–70% of head diameter 2

* *T. monohysteroides* may be identical with *T. monohystera*.

2 Tail ventrally curved. – ♀: L = 0.78 – 1.30 mm; a = 22 – 36; b = 4.3 – 6.0; c = 11 – 27; V = 56 – 67%. ♂ unknown. (Poland, South Africa.) ..... **sheri** BRZESKI

– Tail S-shaped: first ventrally then dorsally curved. 3

3 Tip of tail strongly curved dorsally and also laterally twisted; body 0.8 – 1.0 mm long. – ♀: L = 0.80 – 0.94 mm; a = 20 – 24; b = 4.8 – 5.3; c = 12 – 13; V = 62 – 65%. ♂ unknown. (Italy.) ..... **macroseta** (VINCIGUERRA & LA FAUCI)

– Tip of tail slightly curved dorsally, not twisted laterally; body 1.0 – 1.4 mm. – ♀: L = 1.0 – 1.4 mm; a = 18 – 30; b = 5.3 – 6.4; c = 14 – 20; V = 62 – 67%. ♂ unknown. (Holland, Austria, Italy, Hungary, Soviet Union, India, Vietnam, Sumatra, Fiji, Canada, Mexico, Paraguay.) ... **arenicola** (DE MAN)

Aulolaimus autumnalis sp. n.

(Fig. 11A – G)

♀: L = 0.55 – 0.59 mm; a = 25 – 29; b = 5.0 – 5.5; c = 7.0 – 8.2; V = 53 – 57%; c' = 4.7 – 5.2.

♂: L = 0.59 mm; a = 30; b = 5.1; c = 8.4.

Cuticle about 1 μm wide on mid-body but 1.7 – 2 μm wide at level of the stoma, considerably thicker than the buccal tube; smooth. A very fine annulation occurring on the neck region only. Cuticle bearing about 50 fine, 0.9 – 1 μm wide longitudinal striae.

Head very small, 2 μm wide, laterally pointed, set off by constriction; body at posterior end of oesphagus about 10 times as wide as head. Amphids small, round, 1.5 – 2 cephalic diameters behind head. Buccal tube 68 – 70 μm long and only 1 μm wide, 60% of entire length of oesophagus. Basal bulb 46 – 48 μm long, 40% of oesophageal length, showing in its anterior part 1, in the posterior part 3 transverse wrinkles. Hemizonid small, level with anterior third of bulb. Cardia globular, set off. Rectum nearly as long as corresponding body width.

Distance between oesophagus and vulva 1.6 – 2 times as long as oesophagus, that between vulva and anus 2.3 – 2.7 times as long as tail, Vulva sunk, vulval „alae" (inner cuticularized vulval pieces) 12 – 14 μm wide. Female gonads paired. Egg 62×18 μm, 2.8 times longer than body diameter.

Tail conoid, with pointed tip, 72 – 83 μm long, 4.7 – 5.2 times as long as anal body diameter, its posterior portion devoid of body contents: "empty". Anterior lip of anus protruding.

Male tail 70 μm long, 4.4 times the length of anal body diameter, slightly bent ventrally, empty in its posterior part. Tip of tail pointed. Spicula 20 μm long, hemicircular in shape, in the anterior part somewhat bent dorsally. Gubernaculum with caudal process. Two large and flat preanal supplements located 26 and 35 μm from cloaca.

Holotype: Female on slide No. H – 9791 in the collection of the author.

Type locality: Budapest, Hungary, cemetery of Rákoskeresztur, wet brown sand under dried plant residues, November 1982.

The most important characters of *Aulolaimus autumnalis* sp. n. are the very small and separate head, the cuticular annulation on the neck region, the cons-

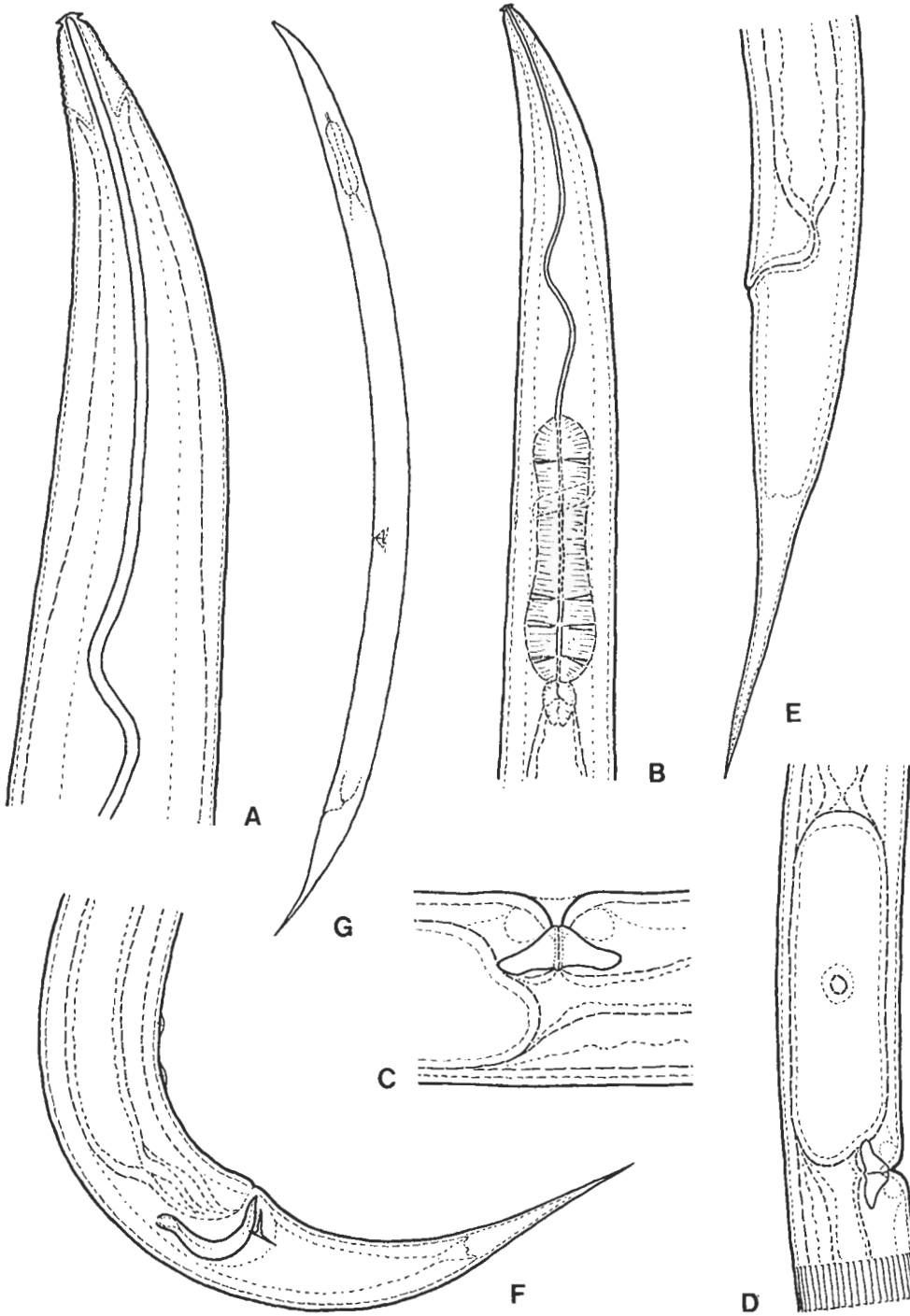

Fig. 11. *Aulolaimus autumnalis* sp. n. A: anterior end (1600×); B: oesophageal region (800×); C: vulva (1200×); D: vulval region (800×); E: female tail (800×); F: male tail (800×); G: entire female (240×)

picuously widened cuticle in the anterior body region, the shape of the vulval alae and the tail which has no body content in its posterior half. In the head shape the new species resembles *A. nannocephalus* ANDRÁSSY, 1972 but the body is smaller, the cuticle swollen on the neck, the tail shorter and empty in the hind part, and the vulva located more back. In number of longitudinal striae, and in shape and length of tail. *A. autumnalis* sp. n. is similar to *A. oxycephalus* DE MAN, 1880, *A. meyli* LOOF, 1961 and *A. mouhitius* (YEATES, 1967) JAIRAJPURI & HOOPER, 1968, it can be distinguished, however, from all of them by the swollen cuticle of the postcephalic region and the shape of the vulval alae.

Key to the species of Aulolaimus

1 Cuticle provided with 16–20 longitudinal ridges 2
– Cuticle provided with 30 or more longitudinal ridges or striae 3

2 Tail filiform, about 15 times anal body diameter, body contents extending into the anterior third or half of tail. – ♀: L = 0.68–0.72 mm; a = 34–36; b = 6.2–6.4; c = 3.3–3.5; V = ? ♂: L = 0.68 mm; a = 35; b = 6.3; c = 3.9. (Bangladesh.) .....
filiformis (TIMM, 1957) JAIRAJPURI & HOOPER, 1968
– Tail conoid, about 6 times anal body diameter, body contents extending almost to tail tip. – ♀: L = 0.71–0.74 mm; a = 26–29; b = 6.2–6.4; c = 6.4–7.2; V = 54–55%. ♂: L = 0.54 mm; a = 28; b = 7.6; c = 5.3; PO = 3. (Italy, Soviet Union [Georgia], Mongolia.) .....
costatus ANDRÁSSY, 1967

3 Tail 10–12 anal body diameters long; distance between vulva and anus 1.2–1.5 times as long as tail; body contents extending to tail tip 4
– Tail 5–8 (exceptionally to 10) anal body diameters long; distance between vulva and anus 2–2.7 times as long as tail; body contents leaving posterior part of tail free. 5

4 Cuticle with about 50 longitudinal striae; head sharply offset. – ♀: L = = 0.77–0.83 mm; a = 31–35; b = 6–7; c = 4.5–4.6; V = 44–48%. ♂ unknown. (Hungary, Soviet Union [Georgia]) .....
nannocephalus ANDRÁSSY, 1972
– Cuticle with 34–40 longitudinal striae; head not set off sharply. – ♀: L = 0.87–0.94 mm; a = 25–28; b = 6.0–7.1; c = 4.5–5.2; V = 45–48%. ♂ unknown. (Soviet Union [Georgia]). .....
andrassyi ELIAVA & ELIASHVILI, 1973

5 Longitudinal striae about 30. – ♀: L = 0.56–0.66 mm; a = 27–29; b = = 3.6–4.0; c = 7.0–8.2; V = 54–60%. ♂ unknown. (Hungary.) .....
bathybius ANDRÁSSY, 1972
– Longitudinal striae about 50 6

6 Body 0.5 mm long; head set off 7
– Body longer, up to 1 mm; head not set off 8

7 Cuticle, level with buccal tube, conspicuously swollen, much thicker than the latter; head very small, 2 μm wide. ♀: L = 0.55–0.59 mm; a = 25–29; b = 5.0–5.5; c = 7.0–8.2; V = 53–57%. ♂: L = 0.59 mm; a = 30; b = 5.1; c = 8.4; PO = 2. (Hungary.) ..... **autumnalis** sp. n.

– Cuticle, level with buccal tube not swollen, thinner than the latter; head wider. – ♀: L = 0.45–0.57 mm; a = 23–27; b = 4.1–6.7; c = 4.6–7.4; V = 52–56%. ♀: L = 0.44–0.57 mm; a = 22–26; b = 4.8–6.8; c = = 7.0–9.0; PO = 2–3. (Holland, Italy.) ..... **meyli** Loof, 1961

8 Vulva in the middle region of body; neck distinctly annulated. – ♀: L = = 0.70–1.04 mm; a = 31–38; b = 6.7–9.0; c = 5.5–9.9; V = 44–52%. ♂: L = 0.73–1.06 mm; a = 33–45; b = 6.6–8.6; c = 8.5–11.2; PO = = 2–3. (New Zealand, Antartica.) ..... **mowhitius** (Yeates, 1967) Jairajpuri & Hooper, 1968

– Vulva more back; neck not or inconspicuously annulated. – ♀: L = 0.62– –0.80 mm; a = 25–30; b = 4.9–5.5; c = 7.8–9.0; V = 56–58%. ♂: L = 0.73–0.80 mm; a = 27–30; b = 5.0–5.5; c = 11–12; PO = 3. (Holland, Switzerland, Hungary, England, Soviet Union [Moldavia, Estonia, Georgia], Ghana, Brasil, Chile.) ..... **oxycephalus** de Man, 1880

Labronema pusillum sp. n.
(Fig. 12A–E)

♂: L = 1.03–1.08 mm; a = 27–31; b = 4.1–4.3; c = 46–48; c' = 1.

Cuticle 1.5–1.8 μm thick on mid-body, extremely finely striated, composed of two distinct layers. Head sharply set off, 15–16 μm wide; body at posterior end of oesophagus 2.3–2.4 times as wide as head. Lip region consisting of the usual six lips and six smaller inner liplets; the latter are sunk in the oral field and occupy about 1/3 of the entire width of the lip region. Amphids chaliciform, nearly half as wide as corresponding body diameter.

Spear 17–18 μm long, 1.2–1.3 times longer than head diameter, somewhat wider than cuticle at the same level, its dorsal wall distinctly longer than the ventral one. Orifice 1/3 of spear length. Guiding ring double but thin. Oesophagus strongly muscular, 252–257 μm long, expanding in 60–62% of its length. Cardia composed of a thin disc and a tongue-shaped process. Prerectum long, beginning a little anterior to the supplements, about 6 times the anal body diameter.

Testes two, spermatozoa oval, 5–6 μm long. Spicula dorylaimoid, 38–41 μm long. Preanal copulatory supplements 9–11, very flat, contiguous; row of supplements 76–82 μm, beginning at about one spiculum length before the spicula.

Tail 22–23 μm long, as long as anal diameter, conoid-rounded, somewhat bent ventrally, with 5 pairs of small papillae.

Female not found.

Holotype: Male on slide No. H–7858 in the collection of the author.

Type locality: Veresegyház, Hungary, grassy soil near a lake, May 1972.

The new species is close to *Labronema mauritiense* Williams, 1959 – both are small and have a similar shape of tail – but differs from it in the following characteristics: body shorter (♂ of *mauritiense* 1.5 mm), spear similarly shorter (*mauritiense:* 21.5–23.5 μm), oesophagus expanding behind the middle, genital supplements fewer (*mauritiense:* 21–24) and located more forward. *Labronema pusillum* sp. n. is one of the smallest representatives of the genus.

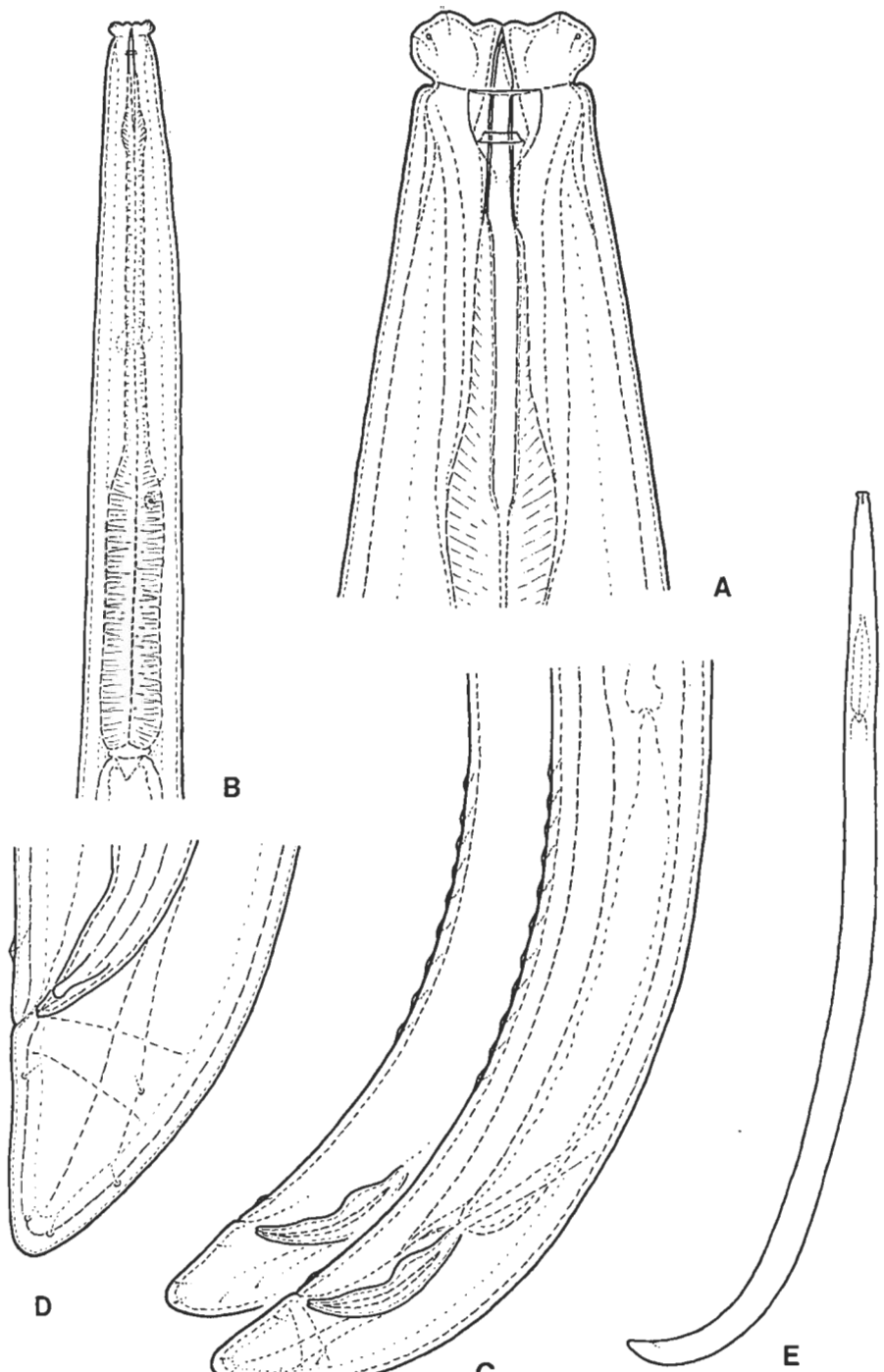

Fig. 12. *Labronema pusillum* sp. n. A: anterior end (1600×); B: oesophageal region (380×); C: posterior ends of males (570×); D: male tail (1200×); E: entire male (120×)

Qudsianematidae. Body 1.2 to 2.8 mm long. Cuticle finely striated radially. Head strongly offset, somewhat discolaimoid, oral field plate-like, sunk, with well separated inner liplets; field of inner liplets wider than one external lip. Spear very slender, about 15 times longer than wide, longer than one head diameter, with large orifice. Guiding ring double. Oesophagus strongly muscular, expanding near the middle. Female gonads paired. Preanal copulatory supplements 11 to 21, close, very low. Tail of both sexes similar, as long as or a little longer than anal body diameter.

Type-species: *Labronemella labiata* sp. n.

The genus *Labronemella* is very close to *Labronema* THORNE, 1939 but the head is *Discolaimus*-like, with deeply sunk oral field and well separated inner liplets, the spear very slender and comparatively long, and the guiding ring double.

Aquatic, semi-aquatic or terrestrial animals.

Five species may be ordered here:

L. andrassyi (BAQRI & KHERA, 1975) comb. n.
Syn. *Discolaimium andrassyi* BAQRI & KHERA, 1975

L. labiata sp. n.

L. loofi (AHMAD & JAIRAJPURI, 1983) comb. n.
Syn. *Labronema loofi* AHMAD & JAIRAJPURI, 1983

L. paesleri (PAETZOLD, 1955) comb. n.
Syn. *Labronema paesleri* PAETZOLD, 1955

L. ruttneri (SCHNEIDER, 1937) comb. n.
Syn. *Dorylaimus (Discolaimus) ruttneri* SCHNEIDER, 1937
Labronema ruttneri (SCHNEIDER, 1937) THORNE, 1939

Key to the species of Labronemella

1 Body length under 2 mm; spicula about 50 μm long. 2
– Body length over 2 mm; spicula generally longer than 50 μm 3

2 Smaller species, 1.2–1.5 mm; prerectum of male beginning within the row of supplements. – ♀: L = 1.24 mm; a = 30; b = 3.7; c = 66; V = 51.5%. ♂: L = 1.51 mm; a = 35; b = 3.3; c = 69; spear = 22 μm: PO = 15. (Sumatra.) ..... **ruttneri** (SCHNEIRER)
– Larger species, 1.5–1.9 mm; prerectum of male beginning well anterior to the supplements. – ♀: L = 1.50–1.86 mm; a = 30–33; b = 3.9–4.0; c = 79–89; V = 54–56%; spear = 23–26 μm. ♂: L = 1.74 mm; a = 30; b = 4.0; c = 92; PO = 14. (India). ..... **andrassyi** (BAQRI & KHERA)

3 Field of inner liplets about as wide as one outer lip; spear 21–24 μm long. – ♀: L = 2.04–2.80 mm; a = 33–39; b = 4.2–5.1; c = 76–112; V = = 47–52%; spear = 21–24 μm. ♂: L = 2.10–2.60 mm; a = 36–44; b = 4.1–5.0; c = 71–93; PO = 19–21. (Germany.) ..... **paesleri** (PAETZOLD)
– Field of inner liplets nearly twice as wide as one outer lip; spear 27–31 μm long. 4

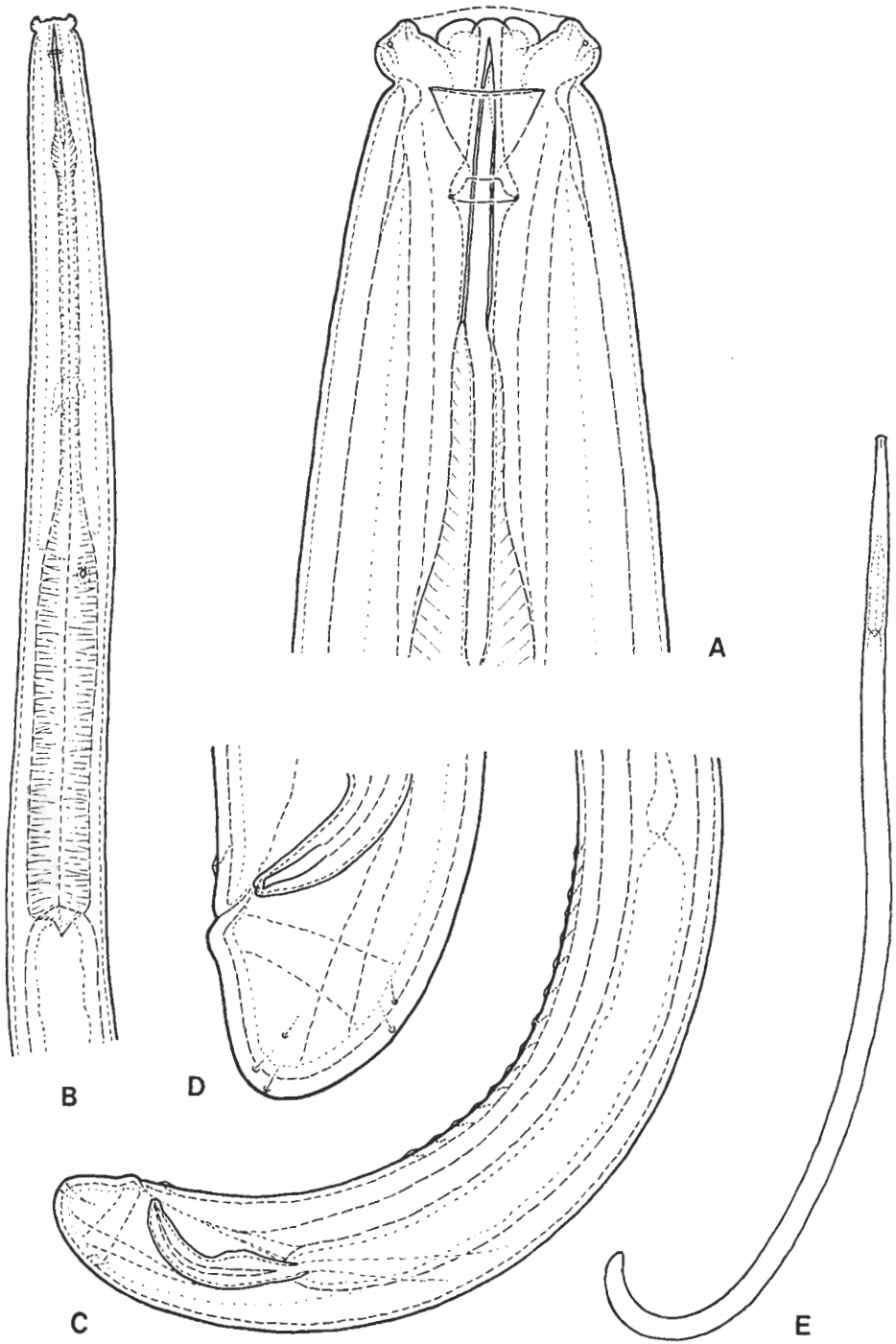

Fig. 13. *Labronemella labiata* gen. n., sp. n. A: anterior end (1200×); B: oesophageal region (270×); C: posterior body of male (380×); D: male tail (800×); E: entire male (60×)

4 Orifice 1/4 of spear length; spicula plump. – ♀: L = 2.27–2.55 mm; a = = 41–44; b = 4.1–4.7; c = 86–106; V = 52–57%; spear = 27–29 μm. ♂: L = 2.06–2.22 mm; a = 36–40; b = 4.2–4.5; c = 84–91; PO = = 11–19. (India.) ..... **loofi** (AHMAD & JAIRAJPURI)

– Orifice 1/3 of spear length; spicula comparatively slender. – ♀ unknown. ♂: L = 2.54 mm; a = 48; b = 5.4; c = 84; PO = 15. (Hungary.) ..... **labiata** sp. n.

Labronemella labiata sp. n.

(Fig. 13A–E)

♂: L = 2.54 mm; a = 48; b = 5.4; c = 84; c' = 0.8.

Cuticle not annulated but finely radially striated, 3.5 μm thick on mid-body. Head set off by constriction, 23 μm wide and 7 μm high; body at posterior end of oesophagus 2.3 times as wide as head. Outer lips discolaimoid or ear-like. Oral field deeply sunk in head contour, with six small rounded liplets. Field of inner liplets 11 μm wide, half as wide as entire head diameter and 3 μm high. Amphids chaliciform, half as wide as corresponding body diameter.

Spear 31 μm long, 1.3 times head diameter, 2 μm thick in the middle part, i. e. about 15 times as long as thick, somewhat thinner than cuticle at the same level. Guiding ring double, around the middle of spear. Orifice 1/3 of spear length. Oesophagus uniformly muscular, expanding a little behind the middle, its total length is 460 μm. Prerectum 235 μm long, 6 times as long as anal body diameter.

Spermatozoa spindle-like, 8–9 μm long. Testes two. Spicula 65 μm long, dorylaimoid, rather weakly cuticularized. In addition to the adanal pair, 15 preanal supplementary organs are present; they are flat, almost contiguous, 140 μm long in a row. Tail 30 μm long, only 0.8 anal body diameter, broadly rounded, with 5 pairs of small papillae.

Female not found.

Holotype: Male on slide No. H–7870 in the collection of the author.

Type locality: Veresegyház, Hungary, sandy soil around grass roots, May 1972.

The distinguishing characteristics between *Labronemella labiata* sp. n. and the other four species of the genus are to be found in the key.

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Studies on the Anderemaeidae J. Balogh, 1972 (Acari, Oribatei)

By

J. Balogh and P. Balogh*

Abstract. Three new *Anderemaeus* species (*A. capitatus*, *A. sturmi* and *A. forsteri* spp. n.) are described. The genus *Yungaseremaeus* Balogh & Mahunka, 1969 is transferred from the family Oppiidae to the family Anderemaeidae. Identification keys to the genera and species of the family Anderemaeidae are added.

The genus *Anderemaeus* was described by Hammer (1958, p. 62) from Bolivia. She collected two specimens east of Cumbre (4000 m) and three ones at Chacaltaya (north of La Paz, about 4900 m), all on very low cushions of different plants (bryophytes, grasses). The species collected here got the name *Anderemaeus monticola* Hammer, 1958.

Balogh and Csiszár (1963) studied several specimens of *A. monticola* Hammer, 1958 and *A. chilensis* Hammer, 1962 collected by Topál (1963) in the province Rio Negro of the Argentine.

Similarly Hammer (1962, p. 53–54) described two further species: *Anderemaeus chilensis* Hammer, 1962, found on three specimens from Puerto Montt and *A magellanis* Hammer, 1962 found on five specimens from the environs of Punta Arenas and from Tierra del Fuego. Also here the localities were low cushions of bryophytes and grasses.

7 specimens of the next species, *Anderemaeus hammerae* Mahunka, 1980 were collected by E. Horak (Zurich) from the Monte Susanna near Ushuaia. The specimens were found in the humid litter of *Nothofagus pumilio*, at the timberline, at height of 460 m.

Found on our examinations, we join three further ones to the 4 *Anderemaeus* species described so far. *Anderemaeus capitatus* sp. n. was found at 3700 m height in Columbia among the dead leaves of *Espeletia hartwigiana: Anderemaeus sturmi* sp.n. in the páramo zone of the Bogotá district. The real surprise, however, was meant by *Anderemaeus forsteri* sp.n., wich the authors identified from Berlese samples collected in New Zealand. While investigations the New Zealand soil fauna, Forster and coworkers collected a number of highly interesting Arthropoda, among them spiders (Araneae) in recent years. Part of these species are related to those of Tierra del Fuego and of the South American Andes.

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Similar results were broght by HAMMER's examinations in the oribatid mites of New Zealand (HAMMER, 1966, 1968). On the basis of HAMMER's research work, 350 oribatid species are known from New Zealand, so this country belongs among the most thoroughly explored ones in oribatidological respect. It seems that in spite of this, still further new species can be expected. It can be said that, relying on the species known today, the range of the genus *Anderemaeus* largely coincides with the upper limit of the *Nothofagus* region and with the páramo vegetation.

The range of the second genus of the Anderemaeidae family, of *Cristeremaeus* BALOGH & CSISZÁR, 1962, is similar. 13 specimens of the species *Cristeremaeus humeratus* BALOGH & CSISZÁR, 1962 were collected by TOPÁL in the province Chubut of the Argentine, near Lago Espejo at height of 1000 m in *Nothofagus antarctica* forest from moss on bark and in soil; 2 specimens of the species *Cristeremaeus clavatus* MAHUNKA, 1980 were collected by HORAK near Ushuaia, in Monte Susanna from the humid litter of *Nothofagus pumilio*.

The only species of the genus *Yungaseremaeus* BALOGH & MAHUNKA, 1969, *Y. longisetosus* BALOGH & MAUHNKA, 1969, was collected by the authors in one specimen in Bolivia between Coroico and Unduavi, at a height of about 2200 m, from living and dead moss. The genus can be understood as an extremely shaped branch of the *Anderemaeus* line of development.

The authors range the genus *Carabodoides* JACOT, 1937 with the family Anderemaeidae with some hesitation. The habitus of the 4 species belonging here are rather different from those of the preceding three genera. Also the geographic range of the species (West Africa, Cuba, Amazonia) utterly differs from those of the preceding ones.

Keys to the genera of Anderemaeidae

1 (2) Legs monodactyle.
Cristeremaeus BALOGH & CSISZÁR, 1963

2 (1) Legs tridactylous.

3 (4) Shoulder without humeral appendage; notogaster each with 2 crista; notogastral setae penicillate.
Carabodoides JACOT, 1937

4 (3) Shoulder with humeral appendage; notogaster without crista; notogastral setae smooth or very finely ciliate.

5 (6) 4 pairs of notogastral setae (*ti*, *te*, *ms* and r_3) very long, ciliate, the remaining ones short.
Yungaseremaeus BALOGH & MAHUNKA, 1969

6 (5) 8–9 pairs of notogastral setae longer; the remaining (*ta*, p_1) short.
Anderemaeus HAMMER, 1958

Cristeremaeus BALOGH & CSISZÁR, 1963

1 (2) Sensillus long, setiform. – The Argentine: Chubut.
humeratus BALOGH & CSISZÁR, 1962

2 (1) Sensillus short, with fusiform head and with a sharp apex. – The Argentine: Tierra del Fuego.
clavatus MAHUNKA, 1980

Carabodoides JACOT, 1937

1 (2) Interlamellar setae setiform, smooth or very finely ciliate. – West Africa.

laticeps BALOGH, 1963

2 (1) Interlamellar setae penicillate, plumose or elongately ciliate.

3 (6) Setae p_2 and p_3 plumose.

4 (5) Notogaster with polygonally arranged granulation. – North America.

saccharomycetoides JACOT, 1937

5 (4) Notogaster with scattered granulation. – Cuba.

granulatus BALOGH & MAHUNKA, 1979

6 (3) Setae p_2 and p_3 setiform, minute, smooth.

7 (8) External crista straight, long, traversing between setae *te* and *ti* and becoming obsolete before setae r_3 and *ms*. – Brazil.

longicarinatus BALOGH & MAHUNKA, 1978

8 (7) External crista essentially shorter, econsiderably obsolescent in front of setae *te* and *ti*. – Brazil.

brasiliensis BALOGH & MAHUNKA, 1969

Anderemaeus HAMMER, 1958

1 (4) Sensillus capitate with medium-long or short stalk.

2 (3) Behind each of setae *in* a chitinous arch; behind each of setae *ta* a chitinous crest; notogaster granulate. – Columbia.

capitatus sp. n.

3 (2) Behind the setae *in* and *ta* no chitinous arch or crest; notogaster foveolate. – The Argentine: Tierra del Fuego.

hammerae MAHUNKA, 1980

4 (1) Sensillus setiform, rod-like or slight fusiform; never with capitate head.

5 (6) Notogastral setae very long, curved with flagellate end; costulae with translamellar connexion. – New Zealand.

forsteri sp. n.

6 (5) Notogastral setae short or medium long, never curved and with flagellate end.

7 (8) Setae p_1 extremely short; setae *ti* and *ms* longer than the distance between setae *ti* and *ms*. – Columbia. **sturmi** sp. n.

8 (7) Setae p_1 only a little shorter then setae r_1; setae *ti* and *ms* shorter than the distance between setae *ti* and *ms*.

9 (10) Notogastral setae with pointed end. – Bolivia.

monticola HAMMER, 1958

10 (9) Notogastral setae slightly thicker towards the tip.

11 (12) Behind the interlamellar setae there are two right-angled ridges. – Chile: Puerto Montt.

chilensis HAMMER, 1962

12 (11) No right-angled ridges behind the interlamellar setae. – Chile: Tierra del Fuego.

magellanis HAMMER, 1962

Yungaseremaeus BALOGH & MAHUNKA, 1969

Unique species. – Bolivia.

longisetosus BALOGH & MAHUNKA, 1969

Anderemaeus capitatus sp. n.

(Fig. 1A – D)

Length: 746 – 812 μm, breadth: 513 – 533 μm.

Prodorsum: Sensillus capitate, with granulate head and with a short stalk. Setae *in* long, erectile, with short scattered cilia. Setae *le* and *ro* short, thin. Costulae sligthly convergent. Extrabothrydial region granulated. There are two chitinous laths behind the setae *in*.

Notogaster: There is a protruding humeral extension on each shoulder, characteristic of the genus. 10 pairs of notogastral setae. Setae *ta* shorter than the remaining notogastral ones; except of one pair of posteromarginal setae (probably the setae p_1) wich are short and curved. There is a chitinous rib each behind the humeral extension. Notogaster with fine, granulate cerotegument.

Ventral side: 6 pairs of genital*, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae; all very short and fine. Pori *iad* in apoanal position. Setae ad_1 in postanal, ad_2 and ad_3 in adanal position.

Material examined: Columbia, Páramo del Huila, 30. VII. 1878, about 3700 m, *Espeletia hartwigiana*, dead leaves, Berlese sample, 1 holotype, 1 paratype,

Remarks: Only one *Anderemaeus* bears a capitate sensillus: *A. hammerae* MAHUNKA, 1980 (Tierra del Fuego), but the sensillus of this species has much longer stalk, the notogastral setae are shorter and the setae p_1 only a little shorter than the r_1 ones.

Anderemaeus sturmi sp. n.

(Fig. 2A – D)

Length: 718 – 720 μm, bradth: 492 – 541 μm.

Prodorsum: Sensillus long, filiform, apically not dilatated, smooth. Setae *in* medium long, erectile, sprasely ciliated. Setae *le* and *ro* short, smooth, thin. Costulae convergent. There are two chitinous tubercles behind the setae *in*.

Notogaster: Humeral extension present on each shoulder. 10 pairs of notogastral setae. Setae *ta* shorter than setae *te* and *ti*. Setae p_1 very short. Notogastral setae on the apical half ciliated.

* The first two of the genital setae are unfortunately omitted on the Fig. 1 B.

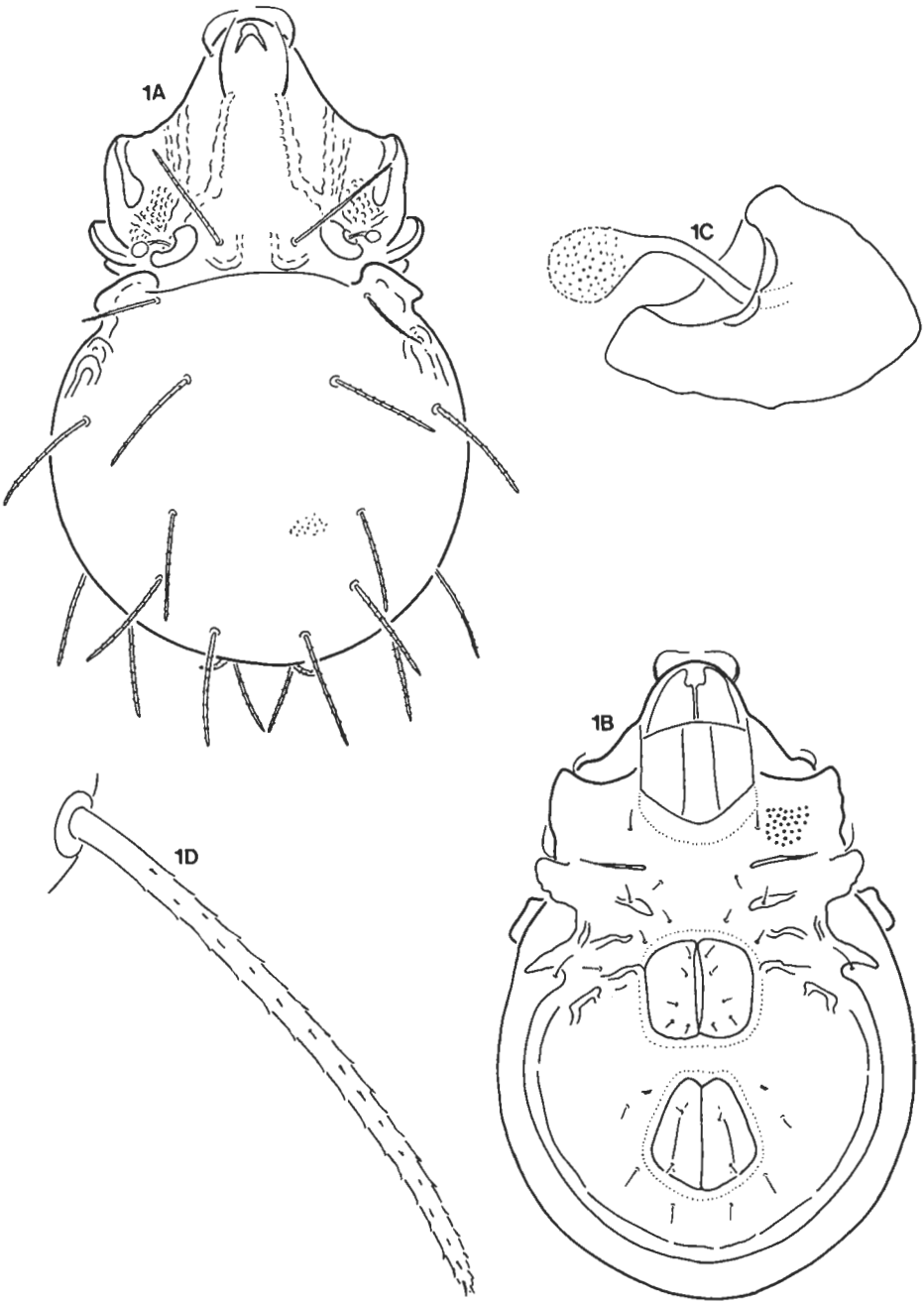

Fig. 1. *Anderemaeus capitatus* sp. n. A: dorsal side; B: ventral side; C: sensillus; D: notogastral seta

Fig. 2. *Anderemaeus sturmi* sp. n. A: dorsal side; B: ventral side; C: sensillus; D: notogastral seta

Fig. 3. *Anderemaeus forsteri* sp. n. A: dorsal side, B: ventral side; C: notogastral seta. – Fig. 4. *Yungaseremaeus longisetosus* Balogh & Mahunka, 1969. A: ventral side

Ventral side: 6 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae, all very short and fine. Setae ad_1 and ad_2 in postanal, ad_3 in adanal position. Pori *iad* apoanal.

Material examined: Columbia, Páramo de Monserrate, 7. III. 1960, 3200–3300 m, 1 holotype, 4 paratypes; Columbia, Iconzo, 5. I. 1968, Puente Natural, Middle Magdalena Valley, about 75 km SW from Bogotá, rest of an undisturbed forest, 3 paratypes; Columbia, Páramo de cocuy, 24. IX. 1978. in *Calamagrostis* soil, 1 paratype.

Remarks: Only *A. chilensis* HAMMER, 1962 (Chile, Puerto Montt) has long, bacilliform sensillus, but this species shows shorter and towards the tip, slightly thicker notogastral setae and its setae p_1 are only a little shorter than setae r_1.

Dedicated to Prof. Dr. H. STURM, discoverer and investigator of the "Espeletia-fauna" of the Andian Páramo.

Anderemaeus forsteri sp. n.

(Fig. 3A–D)

Length: 812–836 μm, breadth: 525–562 μm.

Prodorsum: Sensillus long, rod-like, apically hardly fusiform, smooth. Setae *in* long, curved, setiform; setae *le* much shorter, setiform; setae *ro* shorter than setae *le*. Costulae converging, connected with a translamellar crest; the whole complex reminds of a letter H. There are two chitinous tubercles behind the setae *in*.

Notogaster: Humeral extension present. 10 pairs of long, curved, apically flagellate setae: exception is the seta *ta*, wich is short and setiform. Notogastral setae originating in a chitinous tubercle. Notogaster with thin cerotegument, composed of minute sticks.

Ventral side: Epimeral region with complicated chitinous structures, tubercles and enantiophyses. 6 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae. Setae p_1 in postanal position. Pori *iad* apoanal, on the level of 1st pair of anal setae.

Material examined: New Zealand, Wharau, Wairara, 5. III. 1967, leg. C.L. WILTON; 1 holotype, 3 paratypes.

Remarks: The translamellar ridge, the long, flagellate notogastral setae are unique in the genus.

Dedicated to Mr. FORSTER, pioneer investigator of the soil fauna in New Zealand.

Yungaseremaeus longisetosus BALOGH & MAHUNKA, 1969

(Fig. 4A)

The study of the type material convicted the authors that this genus had to be removed to the family Anderemaeidae J. BALOGH, 1972. To the original description the drawing made now is a substantial proof that the species belongs in this family.

New Oribatids from Australia (Oribatei)

By

P. BALOGH*

Abstract. Five new species collected in various parts of Australia are described: *Pseudotocepheus coarctatus, Pedrocortesella propinqua, P. temperata, P. dispersa* and *P. queenslandica* spp. n. The taxonomic status of the genera *Pedrocortesia* HAMMER, 1958, *Pedrocortesella* HAMMER, 1961 and *Phereliodes* GRANDJEAN, 1931 are discussed.

Pseudotocepheus coarctatus sp. n.

(Fig. 1A–F)

Length: 631–861 μm; breadth: 258–386 μm.

Prodorsum: Costulae somewhat arcuate. Sensillus medium long, slightly fusiform, smooth. Setae *in* short, fine; setae *le* arcuate inwards, smooth, setae *ro* medium long, convergent. There is a triangular window in the rostral region. Extrabothrydial region granulate.

Notogaster: Shoulder region constricted, with two great teeth, each opposite to the bothrydium. Ten pairs of arcuate notogastral setae. Notogastral setae on the apical half unilaterally ciliated.

Ventral side: 3 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae. Setae ad_3 in preanal position, setae p_2 on the niveau of the anterior margin of anal plates. Pori *iad* on the same level as setae p_2, very short and apoanal.

Material examined: Australia, N.S.W., Nightcap Ra., 760 m, 6. V. 1973, subtropical rainforest, leaf litter and soil, leg.: I. NAUMANN; 1 holotype, 2 paratypes.

Remarks: The constricted shoulder region is unique in the genus *Pseudotocepheus* BALOGH, 1960.

Pedrocortesella HAMMER, 1961

In 1958 HAMMER set up a new genus by the name *Pedrocortesia*. In the description of the generotype, *P. mirabilis* HAMMER 1958, she mentions 2 pairs of anal setae, in Figure 41 *c* she presents on the one side 3 and the other one 2 anal setae. In her work on the New Zealand oribatids she draws and describes the *Pedrocortesia* species with 3, the *Pedrocortesella* ones with 2 pairs of anal setae.

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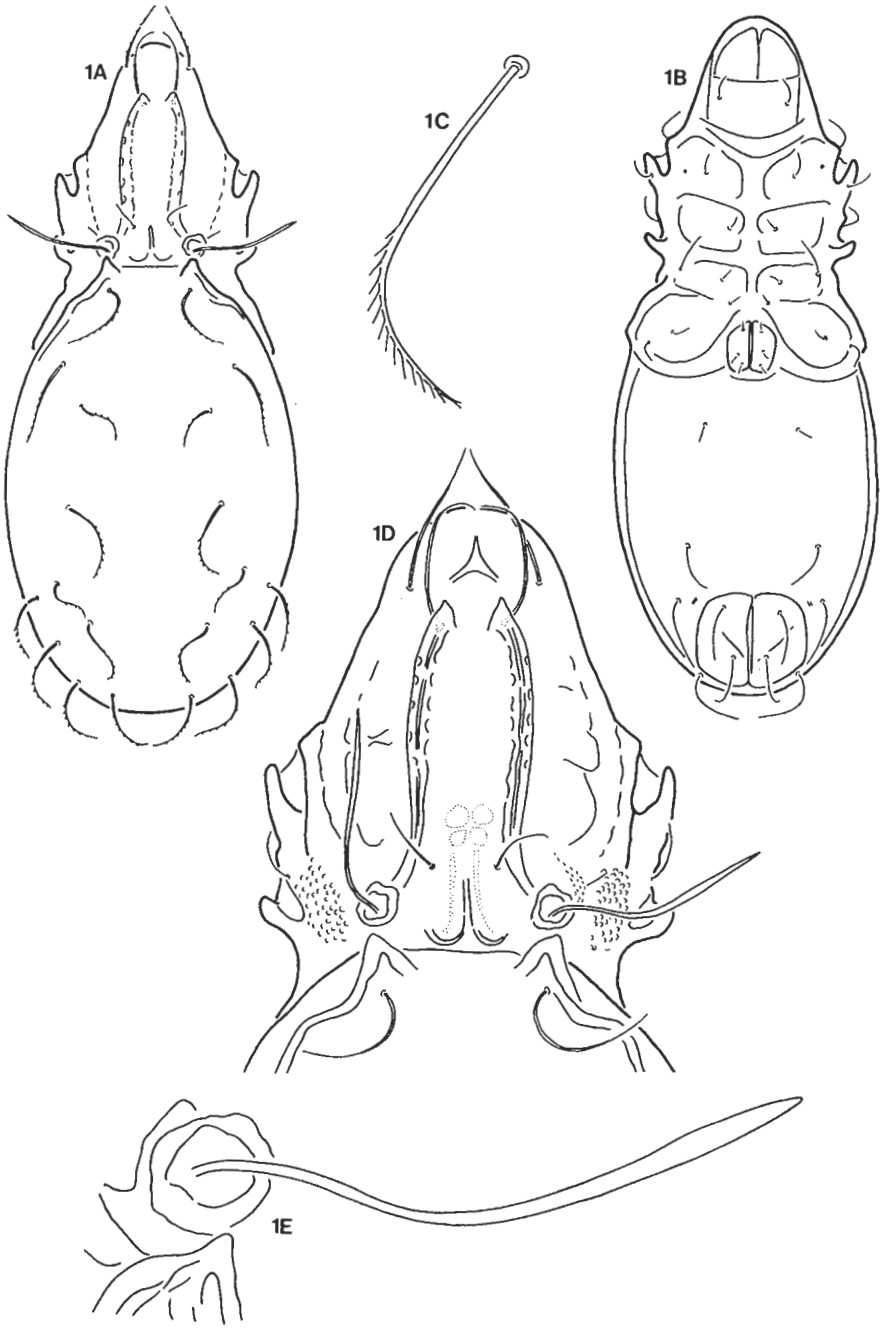

Fig. 1. *Pseudotocepheus coarctatus* sp. n. A: dorsal side; B: ventral side; C: notogastral seta; D: prodorsum; E: sensillus

In 1931 GRANDJEAN ranked the species *Licneremaeus wehnckei* WILLMANN, 1930 in a new genus by the name of *Phereliodes* GRANDJEAN, 1931. In 1965 he redescribed the species. From the redescription it is evident that *Pedrocortesia* HAMMER, 1958 is a junior synonym of *Phereliodes* GRANDJEAN, 1931. The identity is particularly certain on the basis of genital and anal setae, of the enantiophysis on the prodorsum and of the general habitus of the species.

All new species being described here belong to the genus *Pedrocortesella* HAMMER, 1961. The *Pedrocortesella* species are rather similar to one another, and it seems probable that, mainly in the subtropical and tropical regions of the earth, there are living many undescribed species. In his material from Australia the author could distinguish 4 species up to now, all of them are new for science. It seems interesting that none of them could be identified with the 5 New Zealand species. The species can be distinguished from each other mainly on the basis of the sensillus, of the type of the notogastral sculpture and of the number and position of the posteromarginal setae.

Pedrocortesella propinqua sp. n.

(Fig. 2A – D)

Length: 533 μm, breadth: 295 μm.

Prodorsum: Sensillus long, sligthly fusiform, aciculate. Prodorsum foveolated, foveolae different in size. Setae *in* rod-like, small but well visible; setae *le* and *ro* setiform, fairly long.

Notogaster: Foveolated, the foveolae of different size and well separated; the mean distance between the foveolae equal to the half diameter of foveolae. 5 pairs of posteromarginal setae: 1 pair erectile.

Ventral side: The epimeral region with smaller and greater foveolae. Apodemata evanescent. 7 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae. Setae ad_1 in postanal, ad_2 and ad_3 in adanal position. Genital and anal plates near each other: the distance is shorter than the length of the genital plates. Ventral plate foveolated: foveolae have different size. Genital and anal plate foveolated.

Material examined: Australia, N.S.W., Barrington Tops, 1520 m, near Salisbury, 10. II. 1965, temperate rain forest, from *Nothofagus moorei* leaf litter, leg.: G.B. Monteith; holotype 1 exemplar.

Remarks: There are two *Pedrocortesella* species having slightly fusiform, long sensillus, 5 pairs of posteromarginal setae and foveolate or areolate notogaster: *Pedrocortesella pulchra* HAMMER, 1961 (Peru) and *P. gymnonotus* HAMMER, 1966 (New Zealand), but the structure of foveolae and areolae of these species are highly different (see Fig. 59 in HAMMER, 1966 and Fig. 30 in HAMMER, 1961!)

Pedrocortesella temperata sp. n.

(Fig. 3A – D)

Length: 636 – 697 μm; breadth: 353 – 377 μm.

Prodorsum: Sensillus long, slightly fusiform, apical half densely ciliate. Prodorsum foveolated: foveolae nearer to each other than those of *P. propinqua* Setae rod-like, short, setae *le* and *ro* setiform, fairly long. In the interlamellar region there are two evanescent, short chitinous crests.

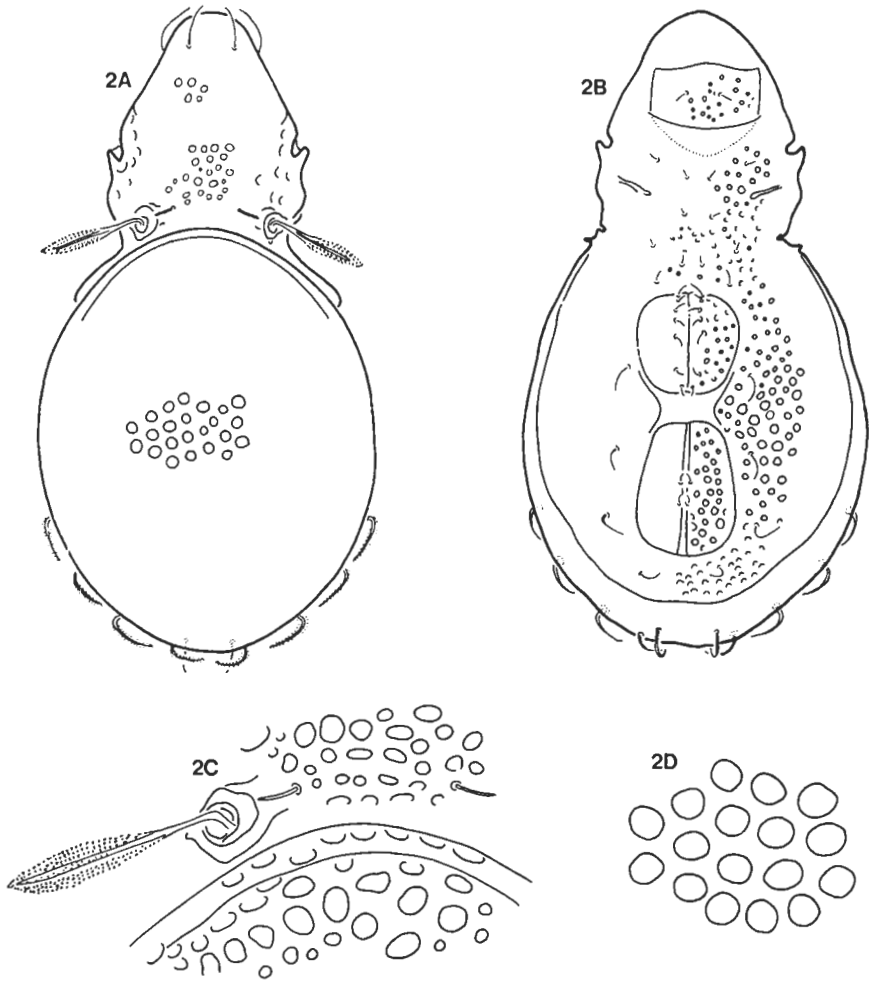

Fig. 2. *Pedrocortesella propinqua* sp. n. A: dorsal side; B: ventral side; C: sensillus; D: sculpture of notogastral area

Notogaster: Foveolated; the foveolae have different size and are close to each other, by greater amplification they remind of the cellular structure. The foveolae of the marginal region are smaller. 3 pairs of visible posteromarginal steae: two pairs posteriorly near each other.

Ventral side: 7 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae. The 4th pair of genital setae are outside of the longitudinal row of genital setae. Genital plates not foveolated.

Material examined: Australia, N.S.W., Barrington Tops, 1520 m, near Salisbury, 10. II. 1965, temperate rain forest, from *Nothofagus moorei* leaf litter; leg. B.B. MONTEITH; 1 holotype, 10 paratypes.

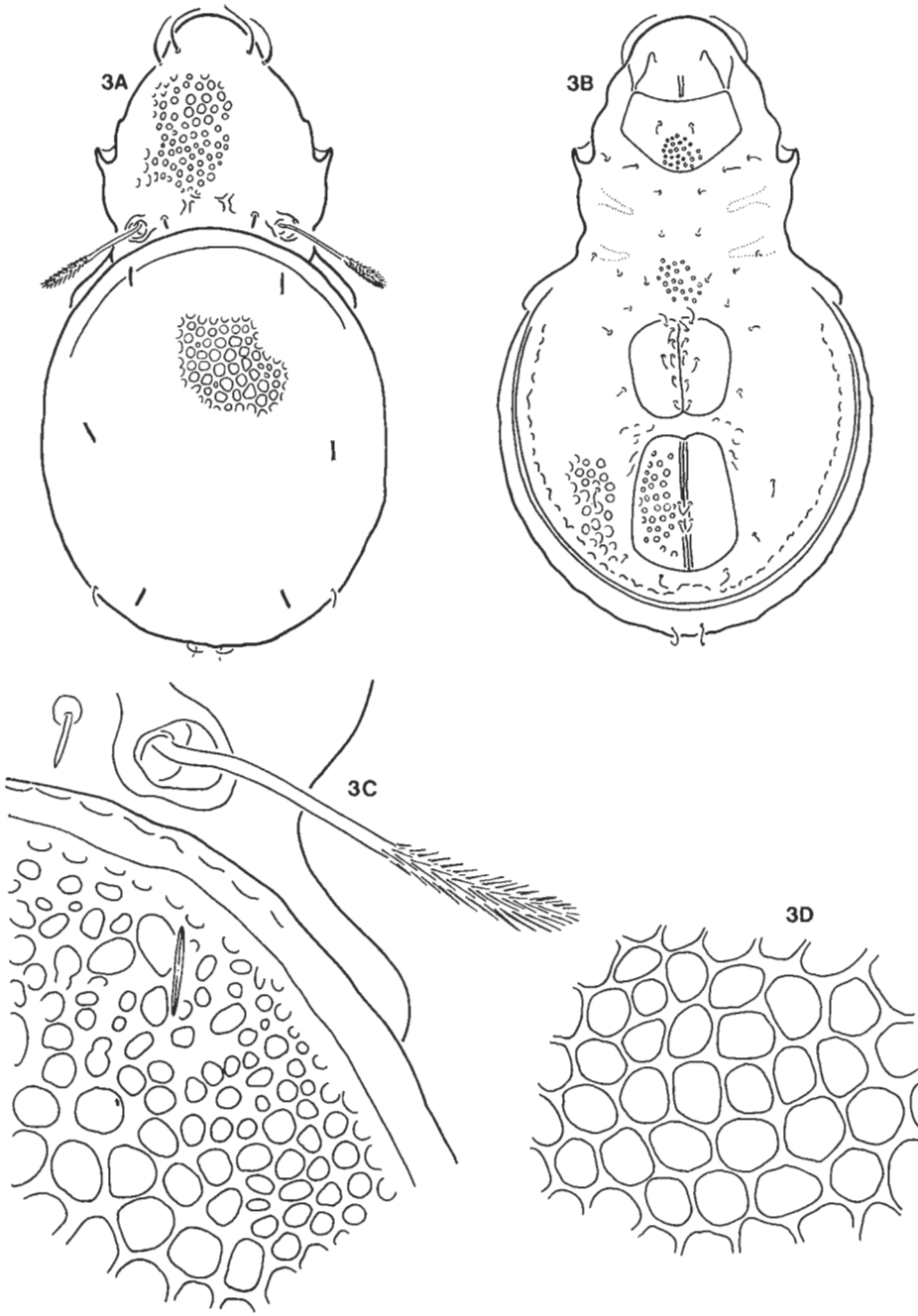

Fig. 3. *Pedrocortesella temperata* sp. n. A: dorsal side; B: ventral side; C: sensillar region; D: sculpture of notogastral area

Remarks: Only three *Pedrocortesella* species have long, sligthly fusiform sensillus combined with greater close to other lying foveolae: *P. pulchra* HAMMER, 1961 (Peru), *P. africana* PLETZEN, 1963 (Africa), *P.parva* PLETZEN, 1963 (Africa); yet these species have a granulated polygonate structure on the notogaster.

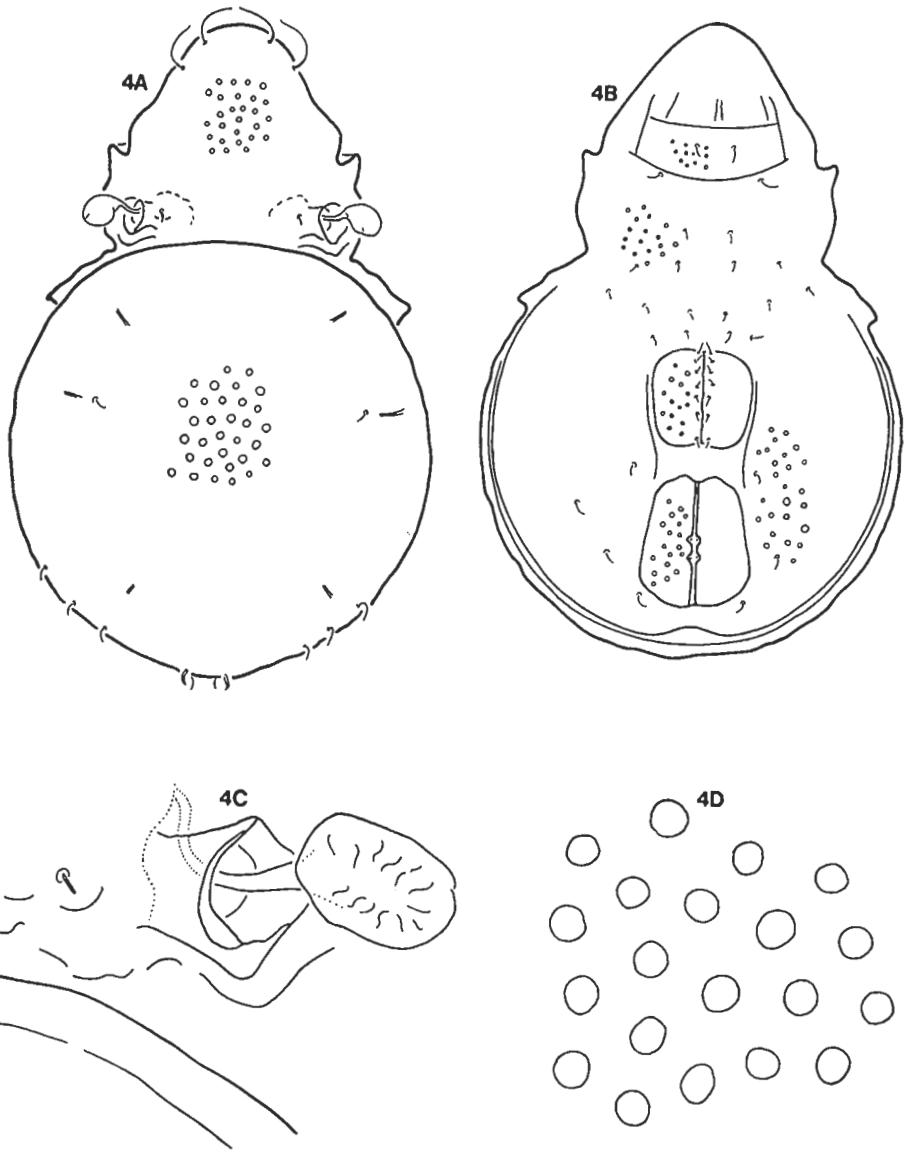

Fig. 4. *Pedrocortesella dispersa* sp. n. A: dorsal side; B: ventral side; C: sensillar region; D: sculpture of notogastral area

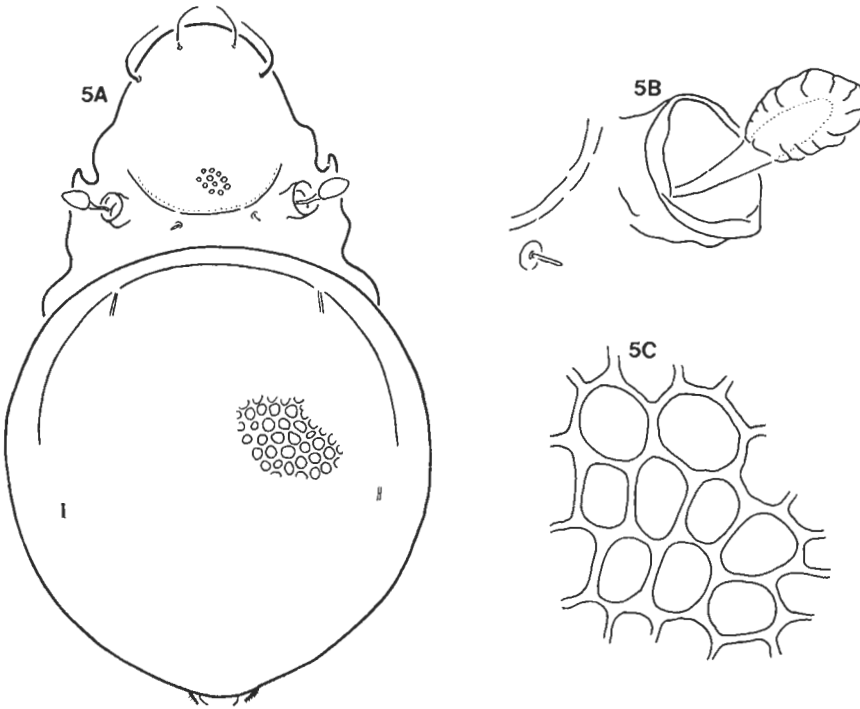

Fig. 5. *Pedrocortesella queenslandica* sp. n. A: dorsal side; B: sensillus; C: sculpture of notogastral area

Pedrocortesella dispersa sp. n.

(Fig. 4A – D)

Length: 533 μm; breadth: 361 μm.

Prodorsum: Sensillus short, capitate with short stalk. Prodorsum foveolated; the mean distance between the foveolae longer than their diameter. Setae *in* rod-like, very small.

Notogaster: With scattered foveolae. The mean distance between the foveolae longer than the diameter of foveolae. 6 pairs of visible notogastral setae: 1 pair near to pori *ip*, 5 pairs in posteromarginal position; two pairs out of five near each other, posteromarginal.

Ventral side: Apodemata evanescent. Epimeral and ventral region; anal and genital plates with scattered foveolae. 7 pairs of very small genital, 1 pair of short aggenital setae; 2 pairs of anal alveoli (anal setae evanescent!), 3 pairs of short adanal setae.

Material examined: Australia, Queensland, Bulburin State Forest, 600 m, subtropical rain forest, from leaf litter, leg.: B.B. MONTEITH; 1 holotype.

Remarks: Several *Pedrocortesella* species have short, capitate sensillus: *P. pulchra* HAMMER, 1961 (Peru), *P. monticola* nom. nov. pro *P. africana* J. BALOGH, 1966 nec *P. africana* PLETZEN, 1963, *P. cryptonotus* HAMMER, 1966 (New Zealand), *P. microclava* HAMMER, 1966 (New Zealand): but all these have no scattered foveolae on the notogaster.

Pedrocortesella queenslandica sp. n.

(Fig. 5A–C)

Length: 636 μm; breadth: 410 μm.

Prodorsum: Sensillus short, capitate, with thin and short stalk. Prodorsum foveolated; foveolae near close to each other, by greater amplification they remind of the cellular structure (as on *P. temperata* sp. n.!).

Notogaster: Foveolated; the foveolae are close to each other (cellular structure!). 2 pairs of visible posteromarginal setae near each other.

Ventral side: Similar to *P. dispersa* sp. n. 7 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae.

Material examined: Australia, Queensland, Bulburin State Forest, 600 m, subtropical rain forest, ex leaf litter, leg.: B.B. MONTEITH; 1 holotype.

Remarks: The *Pedrocortesella* species with short, capitate sensillus (*P. africana, cryptonotus, microclava)* have either more than two pairs of posteromarginal setae or are quite different in notogastral sculpture.

Opusc. Zool. Budapest, XIX–XX, 1985

Some Interesting Oribatuloidea Woolley, 1956 from the Hawaiian Islands (Acari, Oribatei)

By

P. Balogh*

Abstract. One new genus, *Scriptoripoda* gen. n., four new species, *Oripoda prominens, Scriptoripoda excellens, S. tenoriae, Tenuilamellarea hawaiiensis* spp. n. and a new subspecies, *Campbellobates acanthus hawaiiensis* subsp. n., are described. The geographical distribution of Lamellareidae and *Campbellobates* Wallwork, 1964 is discussed.

In the course of the elaboration of the Hawaiian oribatids some highly interesting species were found. Their descriptions and the author's remarks connected with their range are given in the following.

Oripoda prominens sp. n.

(Fig. 1A–B)

Length: 303 μm, breadth: 213 μm.

Prodorsum: Sensillus short, with capitate head and short, thin stalk. Satae medium long, thin, smooth, originated near dorsosejugal suturae. Setae *le* similar to setae *in*. Setae *ro* long, originated marginally. Rostrum broad. Lamellae short, marginal.

Notogaster: Pteromorphae protruding; dorsosejugal suture reaches to the interlamellar setae on prodorsum; anterior margin straigt. Notogaster finely punctuated. 10 pairs of notogastral setae. Setae p_1, p_2, p_3 and r_2 shorter, the remaining ones somewhat longer. 4 pairs of sacculi.

Ventral side: 2 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae. Setae ad_1 in adanal, ad_3 in preanal position. Ventral and anal plates finely punctuated.

Material examined: Hawaii: Maui; Olinda, 9. X. 1968, Makawao Forest Reserve; moss on a lying, decomposing *Metrosideros* stem; 1 holotype; leg.: J. Balogh.

Remarks: The form of the dorsosejugal suture combinated with the position of setae *in* present only on this species.

Scriptoripoda gen. n.

2 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae. Pori *iad* in adanal position. Dorsosejugal suture arched forwards, hence notogas-

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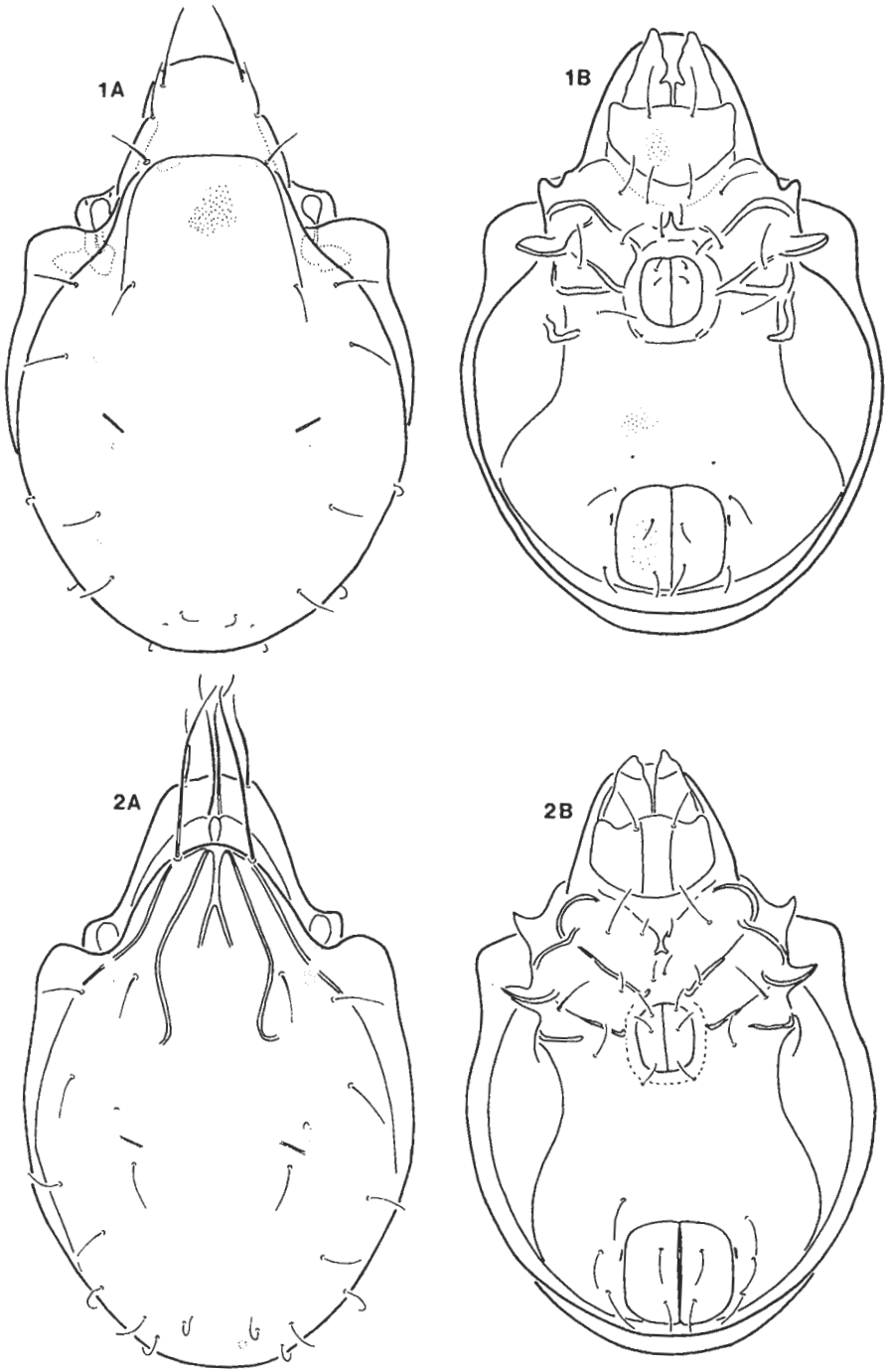

Fig. 1. *Oripoda prominens* sp. n. A: dorsal side; B: ventral side.
Fig. 2. *Scriptoripoda excellens* sp. n. A: dorsal side; B: ventral side

ter covers the basal half of prodorsum.Lamellae short, convergent or connecting; lamellar setae originating near the dorsosejugal suture. There is a chitinous structure, forming a letter M on the anterior part of the notogaster, near the dorsosejugal suture.

Type-species: *Scriptoripoda excellens* sp. n.

Remarks: *Scriptoripoda* gen. nov. derivated from *Oripoda* BANKS, 1904. Distinctive characters: *1)* short, converging or connecting lamellae, *2)* dorsosejugal suture arched forwards, *3)* peculiar chitinous structure on the anterior part of notogaster.

Scriptoripoda excellens sp. n.

(Fig. 2A – B)

Length: 254 μm; breadth: 176 μm.

Prodorsum: Sensillus short, capitate; their stalk covered. Setae *in* very long, much longer than the prodorsum, originated in the dorsosejugal suture. Setae *le* originating near each other, on the basal half of the prodorsum, they are much longer than the prodorsum. Lamellae peculiar: placed immediately before the dorsosejugal suture, connecting medially. Setae *ro* far of each other, medium long. Rostrum broad, truncated. Legs tridactylous.

Notogaster: Dorsosejugal suture arched forward, hence the anterior part of notogaster covered the basal part of prodorsum. On the anterior part of prodorsum there is a chitinous structure, forming a letter M. 10 pairs of notogastral setae: setae $p_1 - p_3$ and r_2 somewhat shorter. Only 3 pairs of sacculi: sacculi *Sa* invisible.

Ventral side: 2 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae. Setae ad_1 and ad_2 in adanal, ad_3 in preanal position.

Material examined: Hawaii, Maui, Haleakala, nearly on the top (about 2980 m), 8. X. 1968, in scattered shrubs with very poor litter and humus; 1 holotype; leg. J. BALOGH.

Remarks: Occurs under extreme ecological conditions; evolved presumably in the Hawaiian Islands.

Scirptoripoda tenorioae sp. n.

(Fig. 3A – B)

Length: 340 μm; breadth: 226 μm.

Prodorsum: Sensillus short, capitate; with covered stalk. Setae *in* and *le* short; originating far form each other on the basal half of prodorsum. Lamellae short, convergent, apices much nearer to dorsosejugal suture than to rostrum. Rostrum broad, reminds of *Anoripoda* SELLNICK, 1959, laterally with two incisions. Setae *ro* a little longer than setae *in* and *le*. Rostrum broadly truncated.

Notogaster: Dorsosejugal suture and chitinous structure similar to those of *Sc. excellens* sp. n. 10 pairs of notogastral setae: position and legnth as in *Sc. excellens* sp. n. 4 pairs of sacculi: sacculi *Sa* present.

Ventral side: 2 pairs of genital, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae. Position and length as in *Sc. excellens* sp. n.

Material examined: Hawaii Island, 6. X. 1968, kipuka on N slope Hualalae, lava soil with 2 – 5 cm high moss and lichens; 1 holotype; leg. J. BALOGH.

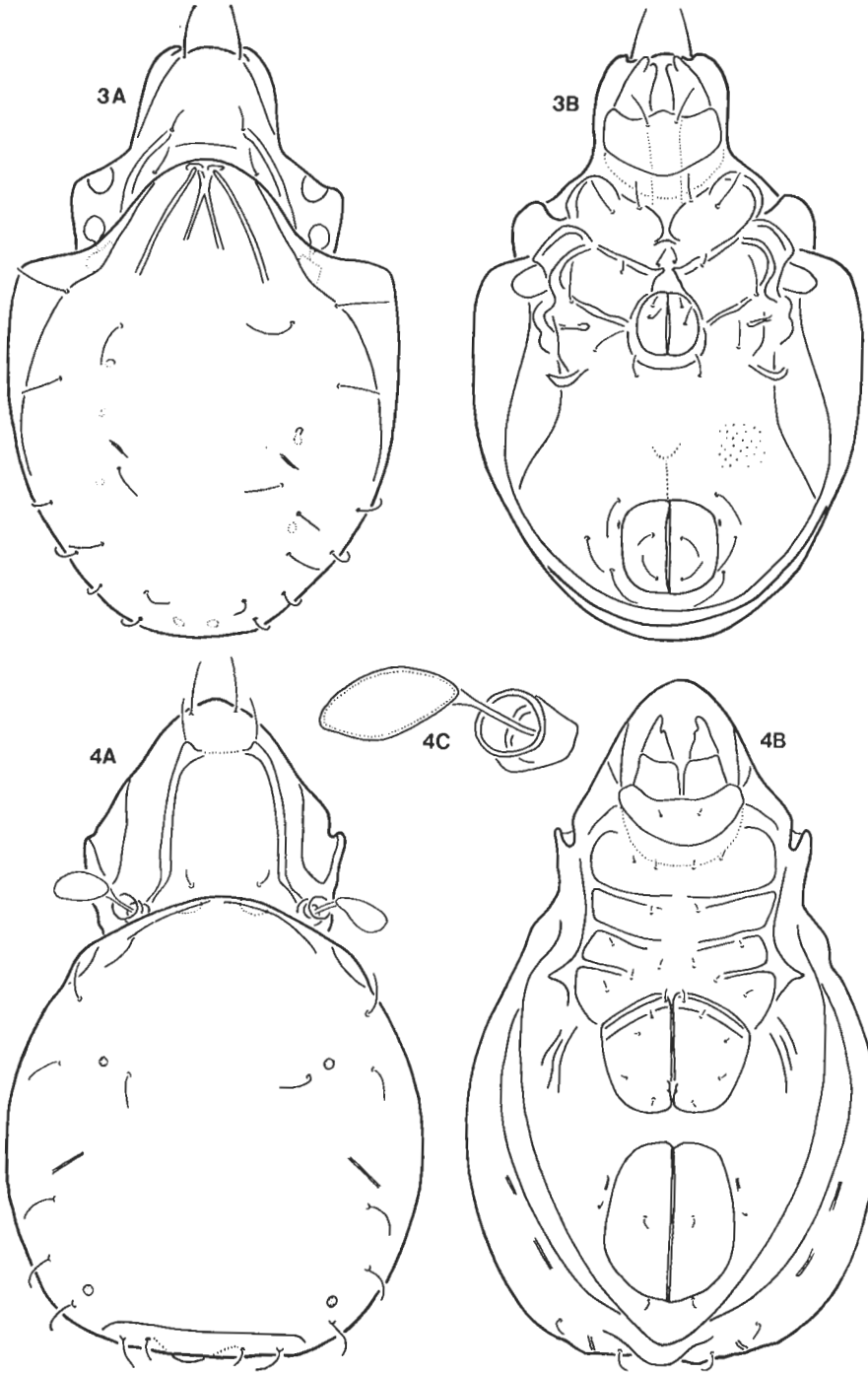

Fig. 3. *Scriptoripoda tenorioae* sp. n. A: dorsal side; B: ventral side
Fig. 4. *Tenuelamellarea hawaiiensis* sp. n. A: dorsal side; B: ventral side; C: sensillus

Remarks: The second species of *Scriptoripoda* differs from the typical species in the form and position of the lamellae and in the length of prodorsal setae.

Dedicated to DR. JOANN TENORIO, acarologist, Honolulu, Bernice P. Museum, for her extensive help during the acarological exploration of the area.

Tenuelamellarea hawaiiensis sp. n.

(Fig. 4A – C)

Length: 221 – 246 μm; breadth: 144 – 160 μm.

Prodorsum: Sensillus medium long, with flattened, capitate head. The head smooth, without ciliae or granulation. Setae *in* very short and thin, setae *le* and *ro* somewhat longer, fine. Lamellae almost parallel, with short cuspis and evanescent translamellar line. Rostrum obtuse, without incision.

Notogaster: 9(?) pairs of short, thin, notogastral setae. (Probably the setae *ms* are hardly discernible?). 1 or 2 pairs of notogastral setae originating in the ventral side. At each shoulder there is a small horizontal pteromorpha. 2 pairs of small areae porosae. Posterior margin of notogaster broadly truncated.

Ventral side: Epimeral setal formula: 2 – 1 – 2 – 2. 5 pairs of genital setae; no aggenital setae. 1 pair of anal, 2 pairs of adanal setae. Genital and anal plates great, occupying almost the total length of the ventral plate.

Material examined: Hawaii, Maui, Olinda, 9. X. 1968, Makawao Forest Reserve, *Metrosideros* litter; 1 holotype, 6 paratypes.

Remarks: This species is one of the greatest surprises presented by the Hawaiian oribatid fauna. The autors described *Tenuelamellarea* SUBIAS & ITURRONDOBEITIA, 1978 from Spain (Yurre, Vizcaya), found on 4 specimens of the species *hispancia* SUBIAS & ITURRONDOBEITIA, 1978, collected in a decidous forest in September, 1977. Up to now 4 species of the family Lamellareidae J. BALOGH, 1972 are known. To the genus *Lamellarea* KOK, 1968 belong three species: *L. ardua* KOK, 1968; *L. digitata* KOK, 1968 and *L. forceps* KOK ,1968; all three of them live in South Africa. The species found in Hawaii bears an extreme resemblance to the species *Tenuelamellarea hispanica* and differs from it only in the smooth sensillus and some quantitative characters. However, the great geographic distance and the difference in climate make hardly uncertain that identical species could be in question. Found on the present disjunct range – South Africa, Spain, Hawaii Islands – one cannot say anything certain about the zoogeographic significance of the family Lamellareidae.

Campbellobates acanthus hawaiiensis subsp. n.

This species was described by WALLWORK in 1964 from the Campbell Islands. In 1966 HAMMER described 3 species of New Zealand of the genus. All 4 species live in moss or lichen growing on the soil, on rotten branches or stones. The 2 specimens collected in the Hawaii Islands lived similarly in moss. Interestingly, the Hawaiian specimens do not resemble the species of New Zealand but the one of the Campbell Islands. They can be distinguished only by slight quantitative differences. The only qualitative difference is that the epimeral region of the Hawaiian specimens is decorated with longitudinal, sligthly blurred wavy lines. No similar structure has ben described in any species. The length of the examined 2 specimens are 275 and 291 μm.

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Examination of the Growth of Blaberus craniifer Burm. (Blattidea)

By

G. GERE*

Abstract. About 80% of the *Blaberus* cockroaches molted nine times in laboratories and at room temperature. On an average, the males attained adult age on the 474th, the females on the 481st day. Their full duration of life was 605 and 754 days, respectively. The length of the successive larval stages show an increasing tendency.

Up to the 7th larval stage the water content of the animals decreased from the initial 74.7% to 65.2%, then it remained on a nearly identical level till they attained adult age. From the 7th larval stage on the body mass of the females became gradually greater than the one of the males. The body mass of the young adult males reached an average of 3300, that of the females one of 4400 mg. Their body mass is growing with time in the character of a cubic progression. Other examinations and data in the literature make probable that this basic form of growth is general among the epimorphous insects. The knowledge of the characteristics of growth of the various animals permits biomass calculations indispensable when surveying the material- and energy exchange of the communities' productivity.

In production biological respect, the role of the animals in the communities can be characterized relying on their material- and energy exchange. In this regard in the first place the interrelated proportions of the material- and energy pathways (incorporation, discarding, respiration) formed on the basis of the vital functions of the organism, as well as the quality conditions of the produced materials are generally taken into consideration. However, when judging the part played, the absolute quantity of the transferred substance depending on time is just as decisive a factor, which is in part identical with the conception of the intensity of the food consumption. The intensity of the animals' food consumption depends on many interior (specific, individual) and exterior (temperature, humidity, quality of food, etc.) circumstances. Most important in this regard is the character of growth and naturally also its duration.

It is a generally known fact that in case of a relative state of equilibrium, out of the offspring of each animal couple within the community on a statistical average two will similarly propagate. The other remaining – and as a rule numerous – so-called marginal individuals (BALOGH, 1953) will become the food of the other members of the community (of the next trophic level built on the semaphoronts of the species in question). These marginal individuals come to be consumed in most cases continuously within the limits set by the duration of life of the species. The question, however, when and how much biomass the spe-

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cies in question will produce and can offer to its consumers is again in a great part decided by the character of growth. Consequently, the rules of growth are of equally determining character in the system of connections of the network of nutrition directed down- and upwards. For this reason, the question constitutes an important part of the knowledge of production biology.

The aim of the author's present work was to make acquanited with the duration of the postembryonal development and with the rules of the changes in body mass under definite conditions of an epimorphous insect, the American giant cockroach (*Blaberus craniifer* BURM.). In the examined respect the author considers this species a model animal, since in the sense of production biological type theory (GERE, 1979) one may assume that the basic character of its growth is similar to that of other epimorphous insects.

Method

The author kept the breeding stock essentially according to WYNINGER's method (1974). He placed the test animals in unglazed earthenware dishes covered with glass plates (GERE, 1958). The dishes he sank into wet sand. Through the porous walls of the vessel an adequate quantity of water was absorbed, from the sand which increased internal humidity. 1—5 cockroaches came into each dish of 8—14 cm in diameter, depending on the size of the animals. In the bottom of the dishes there was litter consisting of wood shavings, where the animals could withdraw.

The food of the animals was the dogs' food "Protecan". The air-dried material of Protecan contains approx. 38% of protein, about half of which is of animal-, half of plant origin. Its primary material is bran. (Verbal information obtained in the producing "Phylaxia" company.) So Protecan can beconsidered a mixed food, that suits best the animal's food demand (LAFON, 1951; BEIER, 1961).

The animals could drink from the water drops on the 20×20 or 30×30 mm glass-plates placed into the dishes. Experimental temperature fluctuated between 20—23 °C.

The water content of the cockroaches was determined by way of drying control animals kept in an identical way with the test animals till weight-balance, at 104 °C.

Examination results

Nearly 80% of the about 600 cockroaches under observation in the experiment molted nine times. With the others ten molts could be observed. WILLNIS et al. (1958) found 10—11 larval stages in the males and 10 ones in the females. The animals of different sex could be differentiated morphologically from the 6th larval stage on.

Table 1 presents the average duration of the larval stages of the cockroaches molting nine times. It can be seen that the duration of the larval stages is, mainly in the second half of the development — in conformity with BEIER's (1961) data — of growing tendency.

Blaberus cockroaches are long-lived insects. Although the average duration of the larval ages of the individuals of the two sexes was nearly identical (with

the males 474, with the females 481 days), the life of the latter was particularly protracted in consequence of the almost 9 months long adult life. Among the given experimental conditions, the males lived 605±49, the females 754±78 days.

The trend of the water content of the animals of various ages can be seen in Table 2. The author performed the measurements at all times in the animals being at the beginning of the actual larval stage. Each of the data shows the average result of 5 parallel measurings. In the single measurings 3 to 5 animals were comprised. The water content in the bodies of the cockroaches definitely decreased up to the 7th larval stage, subsequently to this it remained on a nearly identical level.

Table 1. The average duration of the larval stages and of the imago stage of Blaberus craniifer

Stage	1	2	3	4	5
Duration (days)	36	48	48	49	43
Stage (♂)	6	7	8	9	imago
Duration (days)	47	63	66	74	131
Stage (♀)	6	7	8	9	imago
Duration (days)	48	62	70	76	273

Table 3 informs on the trend of formation of the body mass of the animals. Also in this case the data indicate the conditions prevailing at the beginning of the single stages, and refer to the cockroaches molting nine times. From the Table appears that from the 7th larval stage on the females are of greater body mass than the males. Up to the time they have reached adult age, the difference between the two markedly increases. In dry body mass the relative difference is even somewhat greater than in live weight, because at that age the decrease in water content per cent is greater with the females than with the males. This is caused probably by the accumulation of protein and fatty substance necessary for the formation of the eggs. In adult state the cockroaches still grow on for a time. However, the study does not deal with this question.

Remarkably, there are quite significant differences in size between the animals on identical levels of development. The author observes that at the beginning of the 9th larval stage the body mass of female cockroaches used in other experiments fluctuated between 2400 ans 4780 mg. At this age the smallest animals were those of the grou molting ten times, on the other hand, in their adult age these became larger than the average.

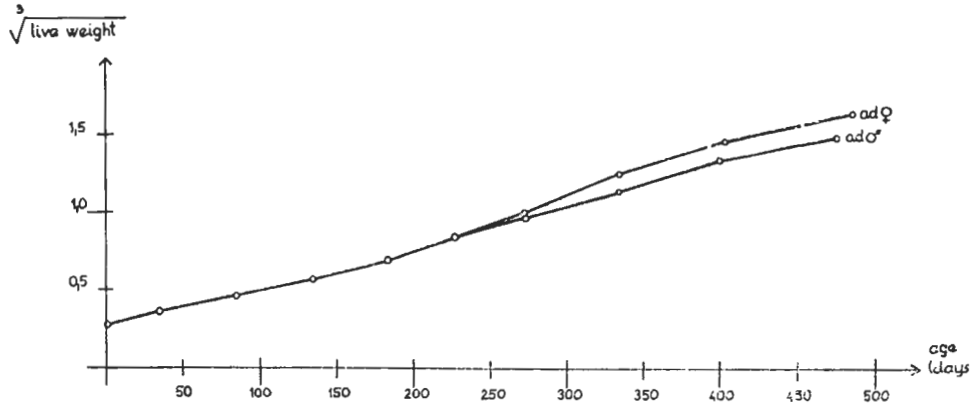

Fig. 1. The curve of increase in weight of *Blaberus craniifer* transformed according to the cubic-root values of the live-weight data

It can also be found out from Table 3, to how much times their original size the animals grew in the single larval stages. This relative rate of growth gradually decreased with advancing age. The first larval stage seems an exception because here, on account of the substantial decrease in water content, it is not the live- but the dry body mass that is of significance.

Valuation

If one represents the 1/3 power of the values of live body mass in the function of time graphically, one obtains an approximately direct line (Figure 1). Consequently, the examined animals grow in a cubic character. The slight S curve to be observed in the Figure reflects the general feature of the animals' growth,

Table 2. The water content of Blaberus craniifer at the beginning of the single larval stages and of the imago stage

Stage	1	2	3	4	5
Water content (%)	74.7 ± 0.7	69.2 ± 0.8	69.7 ± 1.1	67.4 ± 0.4	67.0 ± 0.5
Stage (♂)	6	7	8	9	imago
Water content (%)	66.7 ± 1.2	65.2 ± 0.2	66.1 ± 0.7	65.2 ± 0.6	65.3 ± 1.0
Stage (♀)	6	7	8	9	imago
Water content (%)	66.7 ± 0.3	64.9 ± 0.2	65.1 ± 0.9	65.5 ± 1.0	64.7 ± 0.4

insofar as in the initial and concluding stages the intensity of growth is somewhat slighter as compared with the character of growth. Incidentally, begun from embryonal growth the initial stage may include a shorter or longer part of postembryonal life.

GIER (1947) got a most similar curve of growth when measuring another cockroach, *Periplaneta americana*. It is known from FEWKES's examinations (1960) that also *Stalia major* (Hemiptera, Nabididae) distant from the cockroaches as to relationship, yet similarly epimorphous and also several other species of the family grow like this. The same can be said about the stick-insect *Carausius morosus* (EIDMANN and KÜHLHORN, 1970), as well as about the cricket *Gryllus bimaculatus* (GERE and HUBER, unpublished data).

Relying on the data at the author's disposal, as yet few in number referring, however to epimorphous insects distant from one another as to relationship, it

Table 3. The live- and absolutely dry body mass of Blaberus craniifer at the beginning of the larval stages and of the imago stage, further the relative growth rate during the stages

Stage	Number of the measured animals (pieces)	Live weight	Absolutely dry weight	To how many times its size does the animal grow during the stage
		at the beginning of the stage (mg)		
1	65	24.1 ± 1.9	6.1	1.9
2	50	45.5 ± 3.1	14.0	2.1
3	55	96.0 ± 12.4	29.1	2.0
4	55	195.0 ± 27.3	63.5	1.8
5	50	360.0 ± 52.0	118.9	1.8
6 (♂)	40	643.0 ± 108.2	214.2	1.6
7 (♂)	40	1050 ± 202	364.9	1.5
8 (♂)	40	1600 ± 236	542.2	1.5
9 (♂)	35	2420 ± 394	841.9	1.4
Imago (♂)	35	3300 ± 272	1144.4	–
6 (♀)	45	643.0 ± 108.2	214.2	1.7
7 (♀)	45	1110 ± 176	389.4	1.9
8 (♀)	42	2080 ± 254	726.5	1.6
9 (♀)	42	3260 ± 509	1125.7	1.3
Imago (♀)	42	4400 ± 485	1554.5	–

seems probable that this growth of cubic character is a general feature of the epimorphous insects. Naturally, besides this growth is at all times specific to the species, which – as is known – is modified by a wide variety of environmental factors. Also a period of rest may be inserted into the course of growth. One should also know that at ecdysis growth is interrupted, moreover, at such times a temporary regression in body mass appears (GERE, 1978).

According to our knowledge, at variance with what was said before, the body mass of the holometamorphous insects grows – apart from the initial and ultimate stages – on the whole exponentially, while the weight curve of the birds and mammals comes near to the simple linear function (GERE, 1956, 1978).

At the middle of the duration of its larval life, the *Blaberus* cockroach reaches about 22 and 17% respectively, of the body mass it had at the beginning of its imago age (data referring to males and females). On the other hand, the body mass of the holometamorphous caterpillar *Hyphantria cunea* is, at the half-time of the positive stage of its growth, only 4,2% of the one acquired by it till the end of the said stage (GERE, 1956). Again, the nestling of the song bird *Lonchura striata*,h aving attained the half time of its life within the nest, acquires already 68% of the body mass characteristic of the species (GERE, 1978).

So different are the quotients of the potential biomass produced till the half time of their stages of growth by the various animals. This is the sense in which their part in the food system of the living communities has to be judged. From this it can also be seen how misleading conclusions one could rach if one characterized the lessening in number of the marginal individuals not by registering the decrease of the biomass but merely by indicating the diminution of the number of individuals. In such and similar regards can the information material about the growth of the animals serve with a fundamental basis of forming one's production-biological attitude.

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Methodological Innovations in Connection with the Zoological and Ecological Examinations of the Littoral Region

By

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In consequence of their shallowness, the lakes of Hungary are biological objects of European limnology followed with marked attention. Also their hydrobiological specifity is, in the first place, a consequence of their shallowness. According to classical limnology, in these waters the littoral region has an outstanding significance, i.e. macrovegetation and the productive layer taken in the proper sense of the word mean in these lakes the whole of the lake. The merging into one another of the biological processes, as well as the extensive and simultaneous presence of emergent and submerged macrovegetation greatly impede the follow-up of the processes of zoology, of nutrition biology. All these generally known facts are in part expressed in the data of the literature dealing with zoological research into the areas covered with macrovegetation of the Central European waters.

Literature that could fill a library accumulated up to now on the Rotatoria and Crustecea fauna of the open-water areas of the Polish lake region, of the Balaton, as well as of the Velence and Fertő lakes. On the other hand, compared with these publications, the number of the works dealing with the animal communities of the areas covered with macrovegetation is remarkably low.

Among the papers published on the subject the study of Korinkova (1971) on lakes of Northern Slovakia is prominent. Besides the results also the adopted method is worthy of particular attention in this study. The said method consists in a frame of 1×1 m, which is covered with a net, and of which the lower part is covered with a net, and of which the lower part is shut by means of control from above.

The exact quantitative collection of the planktonic organisms, rotifers and crayfish among plant stands was performed first by Smyly (1952). His results are significant, the methods require an exceeding amount of work and a maximal knowledge of the given terrain. Actually, a generally accepted method of modelling these stands is not yet known even today.

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In the present study the authors report on the zoological collecting methods adopted by them as researchers of hydrozoology of the Zoosystematical and Ecological Intstitute of the Eötvös Loránd University as a routins in the course of the hydrological survey of the Velence and Fertő lakes.

The history of developing the collecting methods

The collections conducted in the lakes Fertő and Velence showed a conspicuous and often almost unexplainable poverty in fauna. The results can be explained by special ecological effects (formation of H_2S, deficiency in O_2). Besides all these, one should by all means take into consideration the special problems connected with the collection technique applied in this terrain.

With the traditional nets of circular shape or of the dredging type representative sampling from reedy, rughy or sedgy stands is a task next to unsolvable. It is by means of these instruments with which the authors took samples from verges of reed fields or from spots of pondweed. However, for collecting animal communities living in several metres high reeds, standing in water the traditional net frames cannot be used. Upon the suggestion of the Austrian hydrozoologist IMHOF, the authors constructed a net frame of drop form (Figure 1), the application of which they found remarkably expedient. The instrument proved best was a frame of 21 cm in length and 9 cm width drawn into a tip. The handling of the net does not demand much practice. The basic condition of the success of the collection is an approach taking care of the site. Besides this, the drawing of the "drop net" from the direction of the mud, upwards from below is important. Otherwise, namely, one has to reckon with the escape of the nimble organisms.

About collecting methods of quantitative character

The emergent macrovegetation areas of the extensive Hungarian shallow lakes are impopulated by animal communities often small in numbers of species, yet at the same time of great numbers of individuals. The authors' own examinations performed up to now prove that in sampling from pondweed fields and reed stands the introduction of a collecting method, relatively simple and also suitable for taking series of samples would be especially important. For this purpose they suggest a series of tubes drawn into one another telescopically (Figure 1b).

With a view to the demand of also collecting the more nimble organisms, here too a cautious approach to the site of collection is highly important. Having cut off the reed stalks above the water, a waiting period of 1/2 to 1 hour is advisable. After this time has passed, the next phase of the work of collection is to apply the appropriate tubes and cutting off the lower parts of the reed stalks. The last phase of sampling is closing by means of the rectangularly bent special net. With this method the authors suggest three parallel samplings from each site, and in this way — according to their observations — the results can easily be evaluated also statistically.

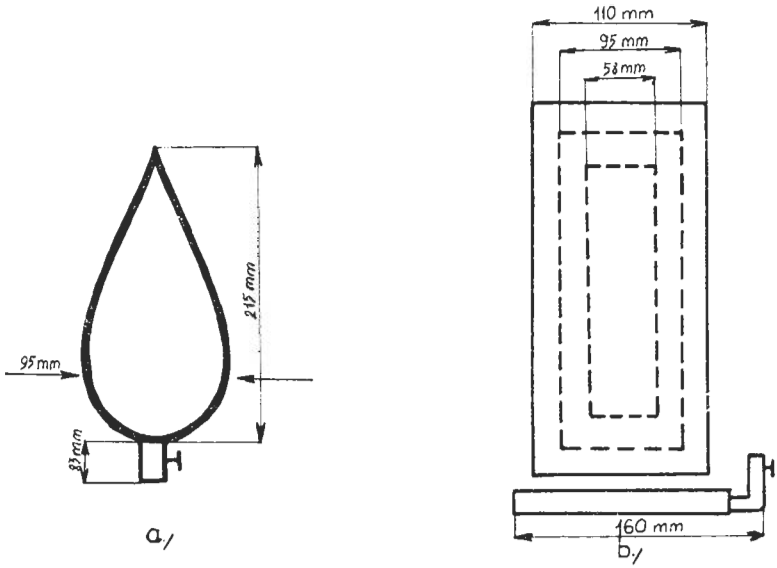

Fig. 1. *a)* The drop-formed collecting net; *b)* Tube series and closing net suitable for quantitative collection

Method of collecting mesoplankton occurring in the open areas of water of the not easily approachable habitats

In reedy or rushy habitats and for zoological collection from under the ice in wintertime the Triplex brand of a hand-driven pump proved good (Figure 2).

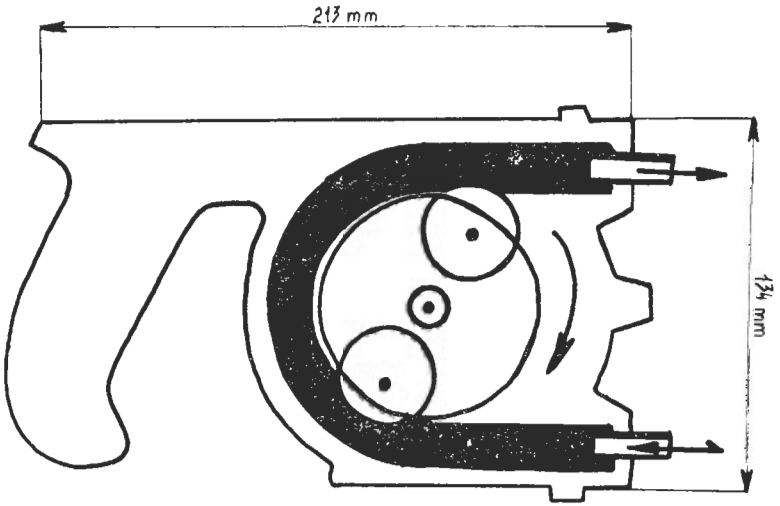

Fig. 2. Sketch of the Triplex pump

In the course of examining the mode of operation, the authors found that at a greater speed of turning the performance of the pump decreased. A probable cause of this is the appearance of the resonance phenomenon. In connection with collecting Cladocera and Copepoda they also conducted experiments in aquaria. The appliance lifted out 100% of the Cladocera and 80% of the Copepoda.

Besides zoological examinations, the simple appliance is by all means suited for performing chemical sampling. According to the authors' laboratory examinations, the samples obtained with this method do not change their original condition, so they can strongly advise the use of this appliance in examinations of micro-stratification and of the special conditions of water chemistry prevailing in the interior of dense plant stands.

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Taxonomische und ökologische Untersuchungen der Plankton-Rotatorien im westlichen Teil des Velenceer Sees, I.

Von

GY. KERTÉSZ und B. CZEGLÉDY*

Abstract. The authors investigated the planctonic Rotatoria fauna living in the western part of the Velence lake, the second largest lake in Hungary. They observed 56 species, of which *Lecane inermis* (BRYCE, 1892), *L. opias* (HARRING & MYERS, 1926) and *L. undulata* HAUER, 1938 proved to be new for the Hungarian fauna, and *Brachionus quadridentatus brevispina* (EHRB., 1832), *Colurella adriatica* (EHRB., 1831), *Euchlanis deflexa* (GOSSE, 1851), *Lecane arcula* HARRING, 1914, *L. flexilis* (GOSSE, 1889), *L. furcata* (MURRAY, 1913) and *L. galeata* (BRYCE, 1892) for the fauna of the Velence lake.

Der Velenceer See ist der zweitgrösste See Ungarns. Durch die Nähe zu Budapest und Székesfehérvár entwickelte er sich neben dem Balaton zu einem der bedeutendsten Erholungszentern des Landes. Für viele dient er ausschliesslich – anthropozentrische Gesichtspunkte berücksichtigend – der Erholung und Entspannung.

Während früher die vorausgehend erwähnten Gesichtspunkte kaum berücksichtigt wurden, stehen diese derzeit im Mittelpunkt des Interesses. Von den heutzutage kennzeichnenden Umweltgestaltungen wird auch der Velenceer See nicht verschont. Um die Ziele besser zu verwirklichen, wurden und werden immer grössere Veränderungen am ursprünglichen Zustand des Sees vollzogen. Durch Tilgen des Röhrichts und Ausbaggerungen wurde das östliche und westliche Bekken allmählich miteinander verbunden; ausser den auch sichtbaren Veränderungen verschwinden auch die im chemischen Charakter des Wassers bestandenen Unterschiede. Bisher ist das westliche Becken verhältnismässig noch verschont geblieben, wenn auch nur stellenweise, lässt sich die ursprüngliche Fauna noch nachweisen. Fraglich ist es natürlich, welchen Einfluss die in den anderen Teilen des Sees vollzogenen Veränderungen auf diese "wenig gestörten" Stellen ausüben werden, oder bereits ausgeübt haben (Abb. 1).

Die grundlegenden limnologischen Verhältnisse des Sees sind von MAUCHA (1931) bekannt gegeben worden. Die seither verflossenen 50 Jahre widerspiegeln weitaus nicht das erforderliche Niveau der weiteren Erkundungen des Sees, wie dies bei anderen einheimischen Gewässern hingegen der Fall war.

Die erwähnten künstlichen Eingriffe drängen Untersuchungen durchzuführen, die sich auf alle Gesichtspunkte erstrecken müssen. Ein Verfolg der

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günstigen oder ungünstigen Veränderungen und deren Bewertung lässt sich nur in Kenntnis regelmässig durchgeführter Untersuchungen erzielen. Sämtliche Tätigkeit, die sich die Erkundung der jetzigen biologischen Verhältnisse zum Ziel setzt, hilft – unserer Meinung nach – der reellen Beurteilung der sich ständig umgestaltenden Verhältnisse. Bezüglich der Benutzung und Gestaltung des Sees wurden bereits jetzt schon scharfe Meinungen und Gegenmeinungen laut, so dass anzunehmen ist, dass die Gestaltungen des Seezustandes, d.h. deren Veränderungen registrierende Untersuchungen mehr denn je an Bedeutung zunehmen werden.

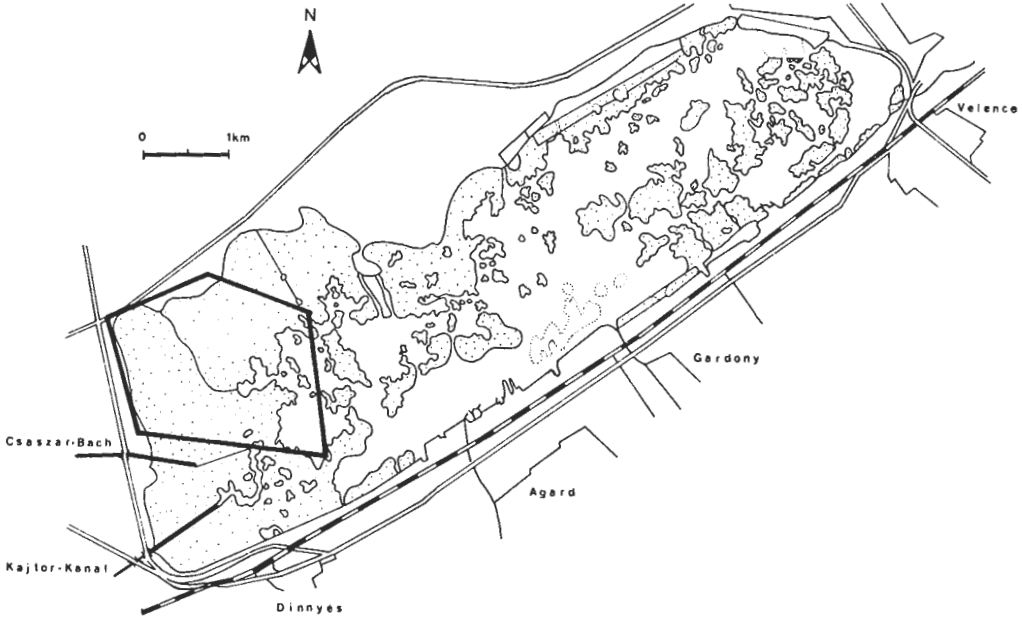

Abb. 1. Übersichtskarte des Velenceer Sees. (Der Naturschutzareal befindet sich an der westlichen Seite)

Durch die Bearbeitung einer bisher wenig untersuchten Tiergruppe im See wollen wir zu dieser Tätigkeit einen Beitrag liefern. Die Beobachtung der Rädertiere (Rotatoria) schliesst sich den bisherigen Erkundungsuntersuchungen anderer Tiergruppen an. Sie bilden auch die Grundlage einer weiteren regelmässig durchgeführten Datensammlung und Auswertungsarbeit.

Zur Begründung der zoologischen Untersuchungen wurden Veränderungen grundlegender hydrologischer Faktoren (Czeglédy et al., 1979) bestimmt. Die Ergebnisse dieser erleichtern die Festlegung der Sammelstellen. Der grösste Teil der Sammelstellen liegt auf dem 6 – 8 km² grossen Naturschutzgebiet des Velenceer Sees. Dies sind die „ursprünglich unberührerten" Gebiete des Sees, wo u.a. zahlreiche seltene Pflanzenarten und auch für die Fauna Europas seltene Tierarten ihre Lebendsbedingungen finden.

Nach der Bekanntgabe dieser Vorereignisse sollen in Anbetracht des Fehlens entsprechender Literaturangaben bezüglich des Vorkommens der Rotatorien-

fauna des Sees, die konkreten Zielsetzungen unserer bevorstehenden Tätigkeit zusammengefasst werden.

1. Quantitative und qualitative Untersuchungen des Rotatorienplanktons im westlichen Teil, im Naturschutzgebiet des Velenceer Sees, an den festgelegten Stellen (Abb. 2).

2. Veränderungen der wasserchemischen Verhältnisse und deren nachweisbarer Einfluss auf die quantitative und qualitative Zusammensetzung des Rotatorienplanktons.

3. Moorflecken – als besondere Lebensstätten – und deren Vergleich aufgrund der quantitativen und qualitativen Verhältnisse des Rotatorienplanktons.

4. Längslichtungen – als Kontrollgebiete – und der Vergleich des Rotatorienplanktons des Naturschutzgebietes.

Literaturübersicht

Wie bereits in der Einleitung erwähnt, sind die grundlegenden limnologischen Verhältnisse, wie hoher Salzgehalt, Ertragsverhältnisse nach MAUCHA (1931) in der internationalen limnologischen Fachliteratur bekannt geworden. Bezüglich der Lebewelt sind nur spärliche Angaben vorhanden.

Hydrologische, meteorologische und Wasserhaushaltsverhältnisse erkundende Untersuchungen wurden von SÉDI in den 30-er Jahren begonnen (SÉDI, 1944). Diese wurden mit Aussetzung einiger Jahrzehnte vom Institut für Wasserwirtschaft ab 1969 regelmässig und laufend weitergeführt (BARANYI, 1973; SZERÉNYI, 1976).

Die physische Geographie des Sees wird von SZABÓ (1933) bekanntgegeben.

Über die Verhältnisse der Wasserqualität unterrichten uns die arbeiten von SCHIEFNER und GREGÁCS (1963, 1964). Ausser wasserchemischen Angaben führt SCHIEFNER (1963) auch einige mit hohen Individuenzahlen vertretene Rotatorien- und Crustaceenarten an.

Parallel zu unseren Planktonuntersuchungen führten ANDRIKOVICS (1973) und BUDA (1980) auch wasserchemische Untersuchungen durch, diese waren uns bei der Wertung unserer Planktonproben von grösster Bedeutung.

Die Zahl der Arbeiten, die sich mit der Lebewelt des Sees befassen, ist verhältnismässig gering. Hauptsächlich sind botanische Arbeiten bekanntgeworden, die Fauna des Sees ist bis zum heutigen Tag hingegen kaum bekannt. Bis 1960 ist die Flora nur durch die Arbeit von BOROS (1959) zusammengefasst worden. Floristisch ist der Velenceer See ziemlich arm, ähnelt diesbezüglich am meisten dem Neusiedler See und dem Palicsi-See.

Die späteren botanischen Forschungen erbrachten den Nachweis solcher Pflanzenarten, die in einem mitteleuropäischen Szik-See theoretisch ihre Lebensbedingungen nicht finden sollten (BALOGH, 1969; KISS, BORHIDI & VAJDA, 1973). Ausser diesen wurden interessante Riedgräser und neue Moosarten der Thora im Becken des westlichen Teiles angetroffen.

Von den Botanikern wurde dieser, als Relikt der ungarischen Wasserflora hinterbliebene Biotoptyp, zuerst als lokale Anomalie gewertet (BORHIDI & BALOGH, 1970). Erst etwas später wurde die Meinung laut, dass diese Moor-Vegetationsflecken Überreste der Entsumpfung sein können (BALOGH, 1971). Die Laichkraut-Karte des Sees wurde von KISS (1972) verfertigt.

Die zoologischen Verhältnisse des Velenceer Sees, einer der grössten Sziksees Europas, wurden – abgesehen von Beobachtungen der Vogelfauna – nicht regelmässig untersucht. Die Forschungen um die Jahrhundertwende beschränkten sich bloss auf die Erschliessung der Fauna. Die ersten Zooplanktonuntersuchungen wurden von DADAY (1897) durchgeführt. In verschiedenen Biotopen des Velenceer Sees konnte er 34 Rotatorienarten nachweisen. Von diesen stammten nur 6 Arten aus dem offenen Wasser, die übrigen wurden an Stellen gesammelt, die mit Vegetation besetzt waren. Erst nach einer sehr langen Zeitspanne wurden anhand der Untersuchungen von MEGYERI (1959) die Copepoden- und Cladocerengemeinschaften zwischen Gárdony und Pákozd erschlossen. Er stellte fest, dass „der Velenceer See einen selbständigen Typ der Szikgewässer darstellt". DONÁSZY (1953) führte auf der Wasserlichtung bei Gárdony regelmässige Zooplanktonuntersuchungen durch. Er konnte bemerkenswerte Zusammenhänge zwischen den Quantitätsverhältnissen des Zooplanktons und den Veränderungen der meteorologischen und chemischen Faktoren feststellen. In den 60-er Jahren sind die Untersuchungen von BERCZIK bezüglich der Benthos-Makrofauna erwähnenswert (1961, 1962, 1967). Die malakologischen Untersuchungen wurden von RICHNOVSZKY (1969) begonnen. Besonders interessant sind die Zooplanktonuntersuchungen von GULYÁS (1972), die sich insbesondere der Erkundung der Cladoceren und Copepoden widmen, und die wichtige Daten zur Charakterisierung des gesamten Sees liefern.

Sammelstellen, Zeitpunkt und Methode

Der grösste Teil der Proben wurde im westlichen Teil des Velenceer Sees, auf dem 6 – 8km² grossen Naturschutzgebiet entnommen. Bloss eine Probe liegt ausserhalb des Naturschutzgebietes, diese wurde auf der „Hosszú-Lichtung" geschöpft und dient als Kontrollprobe. Die im Naturschutzgebiet entnommenen Proben wurden in zwei Gruppen geteilt. Es wurden Proben neben dem Schwimmoor des „Kuti-csapás" sowie aus den Mooraugen der Schwimmore neben der „Német-Lichtung"gewonnen. Vorherige liegt 50 m vom Schlag, letztere 5 m vom Ufer entfernt. Die übrigen 6 Probestellen liegen auf dem offenen Wasser. Diese wurden auf den grösseren offenen Wasserflächen zwischen dem Kerék-Wasser und der Hosszú-Lichtung entnommen (Abb. 2). Die Festlegung dieser Probestellen erfolgte aufgrund vorausgehender, in Serien durchgeführter Temperaturmessungen sowie regelmässig ermittelter wasserchemischer Analysen (CZEGLÉDY & al., 1979). Bereits aufgrund der kurzfristigen Serientemperaturbestimmungen war zu erwarten, dass auf den sich im westlichen Becken des Velenceer Sees erstreckenden, ökologisch vielfaltigen Schwimmooren ausser einer interessanten Flora auch eine mannigfaltige Fauna zu erwarten ist. Auf diesen, derzeit schon als Besonderheiten betrachteten Biotopen ist das Vorkommen solcher Tierarten zu erwarten, die das Faunenbild der einheimischen Szik-Gewässer bedeutend erweitern werden.

Die Entnahme der Proben wurde in der Zeit vom 6. Juli bis zum 10. Oktober, in zweiwöchigen Abständen geplant. Von dieser zweiwöchig geplanten Probenahme wurde nur dann Abstand genommen, wenn die Probestellen nicht erreicht werden konnten, so z.B. in dem Fall, als ein Schwimmoor den Eingang des „Kuti-csapás" vom See her versperrte (Abb. 3).

Bei jeder Probenahme auf offenem Wasser wurde 50 l Wasser durch ein 18 cm Durchmesser betragendes Planktonnetz mit 25-iger Maschenweite gefiltert. Das so gewonnene Filtrat wurde an Ort und Stelle mit Formalin fixiert. Anschliessend wurde dieses Material homogenisiert und quantitativ und qualitativ analysiert.

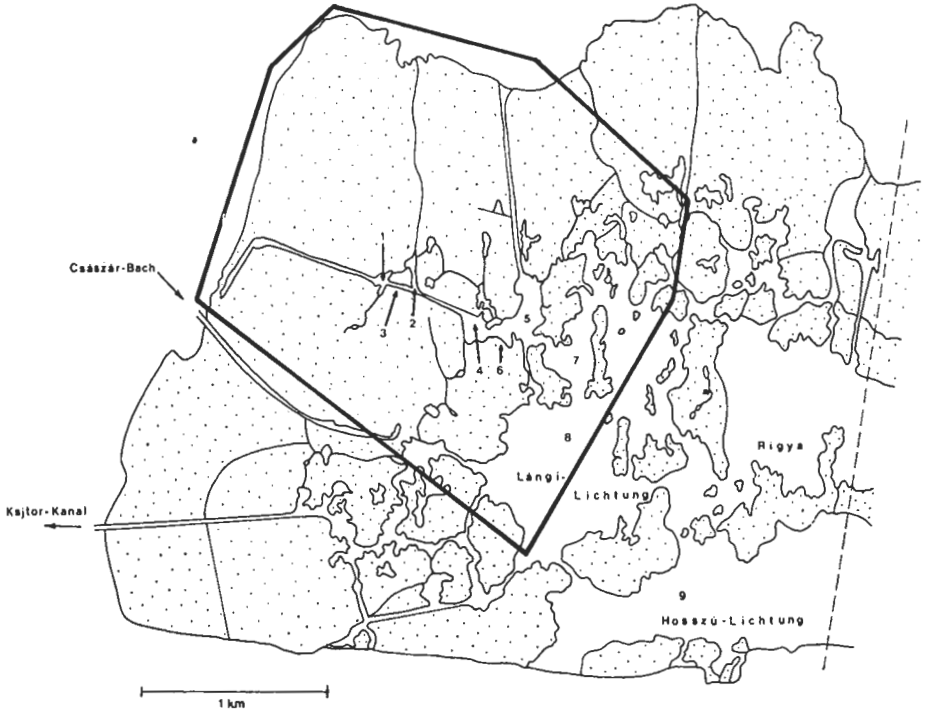

Abb. 2. Naturschutzgebiet am Velenceer See; die Zahlen bedeuten die Probeentnahmestellen

Bei den Proben aus den Mooraugen wurde die Menge des gefilterten Wassers, wegen des hohen Detritusgehalts auf 25 l reduziert. Die Fixation des Zooplanktons und das weitere Verfahren mit dem Material erfolgten wie bei den vorausgehenden Proben.

DieBestimmung der Rotatorien erfolgte aufgrund der Bestimmungsbücher von Voigt (1957) und Bartos (1959), wobei noch zahlreiche andere Spezialarbeiten herangezogen wurden. Bei der Nomenklatur hielten wir uns, um Missverständnisse zu vermeiden, an die Arbeit von Voigt (1957).

Die in Abb. 2 angeführten Fundorte werden nachstehend charakterisiert.

Kerék-Wasser (1). Dies ist der westlichste Fundort und liegt 1 km entfernt von der Forschungsstation Dinnyés, eine mit Röhricht umgebene offene Wasserfläche. Die Farbe des Wassers ist braunschwarz, durchschnittliche Tiefe beträgt 100 cm.

Der Grund wird von einem ungefähr 70 cm hohen Torfhäcksel und stellenweise von Blaualgenflecken bedeckt. Das Wasser wird bereits von einem mässigen

Wind stark aufgewühlt, wobei die abgerissenen Blaualgenrasen auf der Wasseroberfläche schwimmen. Vom Boden steigen Schwefelhydrogenbläschen auf, die ganze Umgebung weist starken Schwefelhydrogengeruch auf. Die Durchsichtigkeit des Wassers wechselte während der Untersuchungsperiode zwischen 30 und 80 cm. Die Durchsichtigkeit des Wassers wird durch den schwebenden Schwefelgehalt, der sich im Wasser aussetzt, stark herabgesetzt, wodurch das Wasser der Lichtung gelblich und trüb erscheint. Wassertemperaturschwankung: 8,6 °C (Max. 21,8 °C, Min. 13,2 °C). Lufttemperaturschwankung: 9,6 °C (Max. 26,4 °C, Min. 16,8 °C).

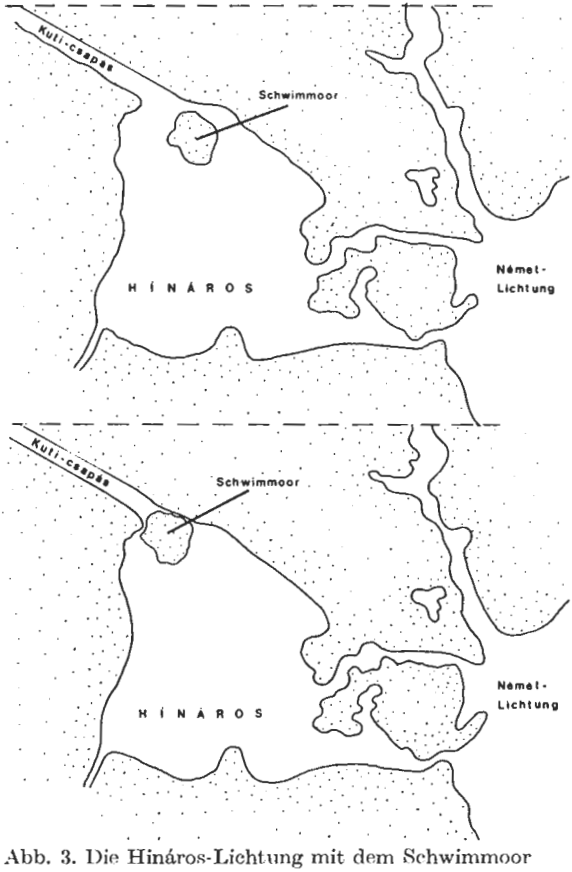

Abb. 3. Die Hináros-Lichtung mit dem Schwimmoor

Gelöster Sauerstoffgehalt des Wassers ziemlich niedrig, wechselte zwischen 0 – 1,38 mg/l. Sauerstoffverbrauch zwischen 16,38 – 23,86 mg/l, spezifische Leitfähigkeit 873 – 1189 μS, pH-Wert 7,48 – 7,90.

Kuti-csapás (2). Ein 1,1 km langer künstlicher Ausschnitt, der die Forschungsstation von Dinnyés mit dem Hináros (4) verbindet. Breite 8 m. Die Probestelle liegt 150 m von den Kerék-Gewässern, die vom Ausschnitt sich öffnen, entfernt. Die Seiten des Ausschnittes werden von Schwimmooren umrandet, nur im Endteil in Richtung des Hináros befindet sich ungefähr 100 m lang im Wasser stehendes Röhricht. Farbe des Wassers ist hier ebenfalls schwarz. Öfters konnten

Blaualgenrasen auf der Oberfläche schwimmend beobachtet werden. Am 7. VIII. waren die Blaualgenrasen so dicht dass nicht nur die Entnahme der Proben verhindert wurde, sondern auch ein fortkommen mit dem Kahn nicht möglich war. Wassertiefe 130 cm. Werte der Durchsichtigkeit zwischen 40 – 120 cm, im allgemeinen tief, aber wegen der Aufwirbelung wurden für das Schwarzwasser nicht kennzeichnende, niedere Durchsichtigkeitswerte gemessen. Wassertemperaturschwankung: 8,8 °C (Max. 21,4 °C, Min. 12,6 °C). Lufttemperaturschwankung: 7,1 °C (Max. 25,0 °C, Min. 17,9 °C).

Gelöster Sauerstoffgehalt 0 mg/l, Sauerstoffverbrauch 20,15 – 23,65 mg/l, spezifische Leitfähigkeit 845 – 1268 μS, pH-Wert 7,19 – 7,9.

Moorauge neben dem Kuti-csapás auf dem Schwimmoor (3). Ungefähr 50 m vom Kuti-csapás entfernt im Innern des Schwimmoors befindet sich eine 1 m² grosse Wasserfläche. Höchstwahrscheinlich steht sie mit dem Wasser unterhalb des Schwimmoores in Verbindung. Darauf weist auch die bedeutende Tiefe hin. Die Wasseroberfläche des Moorauges wird von *Lemna* sp. bedeckt und von *Salix cinerea* und *Thelypteris palustris* beschattet. Die vorausgehenden Mikroklimamessungen zeigten, dass die Temperatur des Wassers bedeutend ausgeglichener ist, als die des Ausschnittes, aber wegen der starken Beschattung viel niedriger. Wassertemperaturschwankung: 5,3 °C (Max. 19,0 °C, Min. 13,7 °C). Lufttemperaturschwankung: 8,2 °C (Max. 25,0 °C, Min. 16,8 °C).

Gelöster Sauerstoffgehalt 0 mg/l, Sauerstoffverbrauch 21,11 – 23,04 mg/l, spezifische Leitfähigkeit 712 – 973 μS. pH-Wert 6,95 – 7,32. Die niedrigste spezifische Leitfähigkeit (712 μS) und der niedrigsten pH-Wert (6,95) wurden am 21. VIII. an diesem Fundort gemessen.

Hináros (4). Liegt von der 2. Sammelstelle ungefähr 350 m entfernt. Dieser Fundort ist ein offenes Wasser von ungefähr 100 m Durchmesser und wird von Schwimmooren und *Cladium mariscus* umrandet. Die einheitliche Wasseroberfläche wird von 10 – 15 m Durchmesser betragenden Schwimmoorteilen unterbrochen, die Lage dieser wird vom Wind verändert. Den westlichsten dieser Schwimmoore kann der Wind bis zum Eingang des Ausschnittes forttreiben, so wie dies der Fall am 16. VIII. gewesen war, wo die dahinter liegenden Fundorte nicht zu erreichen waren (Abb. 3). Auch an dieser Stelle wurde das Auftreiben der Blaualgenrasen beobachtet, wenn auch nicht in den Ausmassen, wie an den vorangehenden Sammelstellen. Wassertiefe 130 cm. Schwarzwasser, Werte der Durchsichtigkeit zwischen 72 – 90 cm. Wassertemperaturschwankung: 11,6 °C (Max. 24,0 °C, Min. 12,4 °C). Lufttemperaturschwankung: 12,2 °C (Max. 28,2 °C, Min. 16,0°C).

Gelöster Sauerstoffgehalt 0 – 3,25 mg/l, Sauerstoffverbrauch 20,37 – 28,09 mg/l, spezifische Leitfähigkeit 747 – 1387 μS, pH-Wert 7,22 – 8,05.

Német-Lichtung (5). Liegt von der vorherigen Sammelstelle östlich 250 m entfernt, eine grössere, offene Wasserfläche von 300 m Durchmesser. Von Schwimmooren umrandet. Die offene Wasserfläche wird durch kleinere-grössere Röhrichtflecken zergliedert. Der Boden ist, besonders im nördlichen Teil der offenen Wasserfläche, mit dickem Torfhäcksel besetzt. Die Wassertiefe beträgt 160 cm; gute Durchsichtigkeit, während der Untersuchungsperiode zwischen 65 – 126 cm, Farbe schwarz. Wassertemperaturschwankung: 12,8 °C (Max. 24,4 °C, Min. 11,6 °C). Lufttemperaturschwankung: 16,9 °C (Max. 30,3 °C, Min. 13,4 °C).

Gelöster Sauerstoffgehalt 0,32 – 5,93 mg/l, Sauerstoffverbrauch 19,96 – 28,86 mg/l, spezifische Leitfähigkeit 908 – 1664 μS, pH-Wert 7,3 – 8,25. Während

der Untersuchungsperiode wurde hier der höchste Sauerstoffverbrauch (28,86 mg/l) am 19. IX. gemessen.

Moorauge des am südwestlichen Rand der Német-Lichtung liegenden Schwimmoores (6). Insgesamt eine 1,5 m² grosse Wasserfläche. Liegt 5 m vom Ufer entfernt, im Röhricht. Die Wasseroberfläche ist dicht mit *Utricularia vulgaris* bedeckt.

Wie die wasserchemischen Analysen erwiesen, steht dieses Wasser mit dem der Német-Lichtung in Verbindung. Wassertemperaturschwankung: 5,6 °C. Weicht von dem Moorauge der 3. Sammelstelle nur um 0,3 °C ab (Max. 24,0 °C, Min. 18,4 °C). Lufttemperaturschwankung: 2,8 °C (Max. 29,5 °C, Min. 26,7 °C).

Gelöster Sauerstoffgehalt 0 – 0,81 mg/l. Sauerstoffverbrauch 21,11 – 22,50 mg/l, spezifische Leitfähigkeit 908 – 1203 μS, pH-Wert 7,6.

Szarvas-föle (7). Ungefähr 300 m östlich der Német-Lichtung ein in Nord-Süd-Richtung sich hinziehendes, cca 400 m langes offenes Wasser. Wird von im Wasser steheden Röhricht umrandet. Die einheitliche Wasserfläche wird in der Nähe des Röhrichts, in deren Verlängerung von Schilfpuppen unterbrochen. Tiefe des Wassers 190 cm. Farbe des Wassers nicht mehr schwarz, geht ins graue über, dadurch ist auch die Durchsichtigkeit geringer, schwankte zwischen 40 – 84 cm. Wassertemperaturschwankung: 13,3 °C (Max. 25,1 °C, Min. 11,8 °C). Lufttemperaturschwankung: 18,8 °C (Max. 31,2 °C, Min. 12,4 °C).

Gelöster Sauerstoffgehalt 2,42 – 6,24 mg/l, Sauerstoffverbrauch 19,47 – 21,03 mg/l, spezifische Leitfähigkeit 1222 – 1632 μS, pH-Wert 7,85 – 8,45.

Lángi-Lichtung (8). Eine grössere, 1 km² Durchmesser besitzende offene Wasserfläche, die mit im Wasser stehenden Röhricht umgeben ist. In der Mitte wird die Lichtung durch die Grenze des Naturschutzgebietes durchquert. Zwischen der Sammelstelle 7 und 8 beträgt die Entfernung 500 m. Die Farbe des Wassers dieser grossen Lichtung ist grau, die Durchsichtigkeit variierte nur zwischen 24 – 40 cm. Wassertiefe 190 cm. Wassertemperaturschwankung: 13,8 °C (Max. 25,2 °C, Min. 11,4 °C). Lufttemperaturschwankung: 14,6 °C (Max. 28,8 °C, Min. 14,2 °C).

Gelöster Sauerstoffgehalt 4,84 – 5,89 mg/l, Sauerstoffverbrauch 19,81 – 21,31 mg/l, spezifische Leitfähigkeit 1270 – 1805 μS, pH-Wert 8,2.

Hosszú-Lichtung (9). Grösste offene Seefläche, die mit der Lángi-Lichtung nur durch einen schmalen, künstlichen Kanal verbunden ist. Das früher weit ausgedehnte Röhricht wurde ausgerottet, heute sind nur noch einige Röhrichtflecke vorhanden.

Das östliche und mittlere Becken bildet derzeit eine einheitliche Wasserfläche, was auch durch die grosse Ähnlichkeit der physiko-chemischen und thermalen Angaben bewiesen wird. Besonders dann nimmt diese Erscheinung Bedeutung an, wenn die Angaben mit denen von ANDRIKOVICS (1973) verglichen werden. Anfang der 70-iger Jahre konnte er in nahe aneinander liegenden Laichkrautbeständen der Hosszú-Lichtung bedeutende physiko-chemische Heterogenität nachweisen. Das Verschwinden der Laichkrautbestände sowie die in den letzten Jahren durchgeführte Ausrottung des Schilfes liess das Mosaikbild vollkommen verschwinden. In den 60-iger Jahren und auch am Ende des Jahrzehntes war eine grosse Durchsichtigkeit des Schwarzwassers noch zu verfolgen. Ständige Ausbaggerungen und eine dem Wind ständige Ausgesetztheit führten dazu, dass der Gehalt an Schweb-

stoffen zunahm und die Durchsichtigkeit des Wassers, auf 20 – 40 cm herabsank. Weiter verschlechtert sich die Lage durch das Ausrotten der noch vorhandenen Röhrichtflecken, wodurch die natürliche Filtration vollständig ausgeschaltet wird. Durch das ständige Ausbaggern wurde zwar erreicht, dass die Tiefe des Wassers 200 cm beträgt, aber das früher durchsichtige Wasser ist auch weiterhin trüb geblieben. Die Oberfläche ist zwar für Sportzwecke und zum Baden ausgezeichnet geeignet, die Selbstreinigung des Wassers versorgenden Röhrichtflecken sind jedoch verschwunden.

Wassertemperaturschwankung: 14,0 °C (Max. 25,6 °C, Min. 11,6 °C). Lufttemperaturschwankung: 15,9 °C (Max. 28,7 °C, Min. 12,8 °C). Gelöster Sauerstoffgehalt 3,42 – 8,39 mg/l, Sauerstoffverbrauch 18,78 – 21,54 mg/l, spezifische Leitfähigkeit 1816 – 2327 μS, pH-Wert 8,21 – 8,50. Die niedrigsten Werte des Sauerstoffverbrauches (18,78 mg/l) wurden während der Untersuchungsperiode am 21. VIII., der höchste Gehalt an gelöstem Sauerstoff (8,39 mg/l) am 6. VII., spezifische Leitfähigkeit (2327 μS) am 16. VIII. und pH-Wert (8,5) am 19. VII. an dieser Sammelstelle gemessen.

Wertung der Ergebnisse

Es wurden 70 Planktonproben von 9 verschiedenen Sammelstellen bezüglich ihrer Rotatorienfauna bearbeitet und gewertet. Besondere Aufmerksamkeit wird den bereits im Velenceer See früher angetroffenen Arten gewidmet sowie denen, die jetzt zuerst vorkamen und deren allgemeiner Verbreitung. Mit besonderem Interesse verfolgen wir diejenigen Arten, die bisher in Ungarn und Europa nicht gemeldet wurden.

Die während der Untersuchungsperiode gesammelten Rotatorien-Arten werden in Tabelle 1 zusammengefasst. In der Tabelle werden die an den einzelnen Fundorten angetroffenen Arten angeführt (ohne quantitative Angaben), ausserdem wird angegeben, ob es sich um euplanktische (e) oder tychoplanktische (t) Formen handelt.

Kurze Charakterisierung der häufigsten Arten

Die im Untersuchungsgebiet angetroffenen Arten werden in erster Linie anhand der einheimischen Literatur und der anerkanntesten fremden Literatur bekanntgegeben, wobei besonders das Vorkommen in Ungarn berücksichtigt wird.

Anuraeopsis fissa (Gosse, 1851)

Euplanktonische, warmstenotherme Art (Varga, 1937), wurde selten auch zwischen Wasserpflanzen angetroffen. In einheimischen Gewässern allgemein verbreitet. Im Neusiedler-See wurde sie von Varga (1926), im Belső-See von Tihany ebenfalls von Varga (1937), im Kleinbalaton von Varga (1944/45), in kleineren Stehgewässern (Baláta-See) von Megyeri (1965), in Szik-Gewässern der Grossen Ungarischen Tiefebene von Megyeri (1959) und im Velenceer See von Gulyás (1972) nachgewiesen.

Während unseren Sammlungen konnte sie allein im Kuti-Moorauge (3) nicht angetroffen werden. An den anderen Stellen war sie zu jeder Zeit vorhanden. Die höchste Individuenzahl (1404 Ind/10 l) zeigte sie im Oktober bei einer Wassertemperatur von 13,2 °C, und zwar an der Sammelstelle Kerék-Wasser (1).

Brachionus angularis GOSSE, 1851

Seichte Gewässer kennzeichnende, häufig vorkommende Art. Bewohner freier Ufer (DADAY, 1892), kommt jedoch auch zwischen Wasserpflanzen vor (DADAY, 1892). VARGA (1928, 1932, 1953, 1959) fand sie öfters in verschiedenen Stehgewässern, so z.B. in Kubikgruben an der Theiss, im Balaton, in Bátorliget und im Szelidi-See. Interessant ist die Aussage von VARGA (1932), dernach er sie im Balaton nur bei einer Gelegenheit in geringer Individuenzahl sammeln konnte. Dies unterstreicht die Feststellung, dass sie in erster Linie in seichten Gewässern häufig anzutreffen ist. Aus den Szik-Seen der Grossen Ungarischen Tiefebene wird sie von MEGYERI (1959, 1965) aus dem Baláta-See gemeldet, KERTÉSZ erwähnt sie aus Szik-Gewässern bei Farmos (1956) und aus dem Péteri-See (1960).

Im Velenceer See konnte sie an allen Sammelstellen angetroffen werden. Aus den Mooraugen, als besondere Biotope, war sie bisher nicht nachweisbar. Höchste Individuenzahl (1136 Ind (10/l) wurde ebenfalls im Kerék-Wasser gesammelt (17. VII.).

Keratella cochlearis (GOSSE, 1851)

Sozusagen in allen einheimischen Stehgewässern anzutreffende, euplanktonische, formenreiche Art. Bei unseren Sammlungen wurde die typische Form, *Keratella cochlearis typica* angetroffen. VARGA fand sie in Kubikgruben der Theiss (1928), im Balaton (1939, 1932, 1941), im Belső-See (1937), und im Szelidi-See (1959). KERTÉSZ erwähnt sie im Péteri-See (1960) als häufige Art, in der Donau (1962) als ständig anzutreffende Spezies. MEGYERI (1959) erwähnt sie aus den Szik-Gewässern der Grossen Ungarischen Tiefebene. GULYÁS (1972) erwähnt sie aus dem Velenceer See als ständige und häufige Art. Wir konnten sie ebenfalls an allen Sammelstellen vorfinden. Wie beobachtet werden konnte, steigt die Individuenzahl dieser Art vom Schwarzwasser zum Grauwasser an. Höchste Individuenzahl (2164 Ind/10 l) wurde bei Szarvas-föle am 10. IX. bei einer Wassertemperatur von 20,4 °C nachgewiesen.

Bedeutend ist sie im Német-Moorauge als euplanktonisches Element, ständig und in hoher Individuenzahl, da dies ebenfalls ein Beweis dafür ist, dass das Moorauge mit dem offenen Wasser in intensiver Verbindung ist. Die Rotatorienfauna dieses Mooraugs unterscheidet sich vollkommen von dem abgeschlossenerem Kuti-Moorauge.

Pedalia mira (HUDSON, 1871)

Eine euplanktonische, warmstenotherme Art der Stehgewässer. In der einheimischen Fauna von Juni bis Oktober sehr häufig anzutreffen (VARGA, 1931). DADAY (1894) wies sie aus den Szikgewässern der Grossen Ungarischen Tiefebene nach. VARGA (1926) fand sie im Neusiedler-See, im Totenarm des Körös (1931), im Balaton (1932), im Belső-See bei Tihany (1937) und in Bátorliget (1953). Aus den Totenarmen der Theiss und als Charakterart der Szik-Gewässer erwähnt sie MEGYERI (1961, 1963). MEGYERI (1965) erwähnt sie auch aus dem Baláta-See.

Nach GULYÁS (1972) ist sie in den Sommermonaten im Velenceer See eine mit hoher Individuenzahl vertretene Art, im Frühjahr und Herbst fällt ihre Individuenzahl stark ab. Diese Feststellung wird auch durch unsere Untersuchung-

en bewiesen; sie fehlte nur im besonderen Biotop des Kuti-Moorauges. Trotz ihrer allgemeinen Verbreitung erreichte sie die höchste Individuenzahl in der Lángi-Lichtung.

Polyarthra vulgaris CARLIN, 1943

Kennzeichnende Art der Sommerperiode, aus einheimischen Gewässern gut bekannt. KERTÉSZ (1956, 1960) fand sie in den Szikgewässern der Grossen Ungarischen Tiefebene, VARGA (1954, 1959) in Quellen des Börzsöny-Gebirges und in Szikgewässern, im Szelidi-See. Er erwähnt sie als kennzeichnende Art der einheimischen eutrophischen Seen. KERTÉSZ (1962) konnte sie auch in der Donau nachweisen.

Aus dem Velenceer See wird sie von GULYÁS (1972) erwähnt, doch konnte er sie nicht an allen Fundorten antreffen. Während unseren Untersuchungen wurde sie an allen Sammelstellen erbeutet, auch im Moorauge des Schwimmoores beim Kuti-csapás, wenn auch nur bei einer Gelegenheit am 4. IX. (vier Exemplare).

Neue Arten für die Fauna des Velenceer Sees

Brachionus quadridentatus brevispinus (EHRB, 1832)

In kleinen und grösseren Stehgewässern lebende, Süss- und Brackwasser liebende Art. In der Vegetation der Ufergebiete, aber auch im offenen Wasser vorkommende Art (VOIGT, 1957). VARGA (1926) fand wenige Individuen im Neusiedler-See, im Balaton im Sommer zwischen Pflanzen hohe Individuenzahlen (1944/45). Ferner wurde sie vom selben Autor aus der Gran (1957) und aus dem Szelidi-See nachgewiesen (1959). KERTÉSZ (1956) beschreibt sie als häufige Art aus den Szikgewässern von Farmos, aus dem Péteri-See (1960) und aus der Donau (1962).

Aus dem Velenceer See war sie bisher nicht bekannt. Wir haben auch bloss ein Exemplar am 17. VII. im offenen Wasser des Kuti-csapás erbeuten können. Es ist anzunehmen, dass sie durch den Wind aus der Ufervegetation ins offene Wasser gelangt ist. Weitere Aufsammlungen sind dazu nötig, um ihre Verbreitung und Biotope erkunden zu können.

Colurella adriatica EHRB., 1831

Tychoplanktonische Art. VARGA (1939) fand sie zwischen Wasserpflanzen im Balaton, im Geflecht von *Cladophora* (1941) und in anderen Biotopen (1932, 1957). Dergleiche Autor konnte sie im Kleinbalaton (1944/45), im Szelidi-See (1959) und auch in der Őzberek-Quelle bei Diósjenő ebenfalls nachweisen (1954). Bei jeder Gelegenheit kommt er zum Schluss, dass es eine häufige Art ist, sie ist aber nur in geringer Individuenzahl vertreten. KERTÉSZ (1962) erwähnt sie ebenfalls häufig in der Donau angetroffen zu haben. Aus dem Velenceer See wird sie von GULYÁS (1972) angeführt, es wurde jedoch nur je ein Exemplar im Határi-Schilf 1970 und 1971 erbeutet. In Szik- und Moorgewässern der Grossen Ungarischen Tiefebene wurde sie von MEGYERI (1959, 1965) nachgewiesen. Wir fanden ein Exemplar im Moorauge des Schwimmoores neben dem Kuti-csapás am 17. VII. Seit MEGYERI ist dies der zweite Fundort in Moorwasser.

Euchlanis deflexa (Gosse, 1851)

Nach Voigt (1957) kommt sie in der Vegetation der Uferregion kleinerer oder grösserer Stehgewässer vor, manchmal auch im Plankton. Häufig wurde sie auch in Fliessgewässern nachgewiesen.

Von Varga wurde sie in den Kubikgruben der Theiss (1928), im Balaton (1932, 1944/45), im Belső-See von Tihany (1937), in Bátorliget (1953) und im Gran-Fluss (1957) gesammelt. Im Neusiedler-See wurde sie vorwiegend im Frühjahr angetroffen (Varga, 1926). Kertész (1962) erwähnt sie als häufige Planktonart aus der Donau. Bisher wurde sie im Velenceer See nicht gesammelt. Zuerst sammelten wir sie am 19. IX. 1979, aber nicht in den bisher bekannten Biotopen, sondern im Moorauge neben der Német-Lichtung.

Lecane arcula Harring, 1914

(Abb. 4a)

Diese Art bevorzugt mit Wasserpflanzen dicht bedecktes Wasser, kommt in Meeren und im Salzwasser gleicherweise vor (Voigt, 1957). Aus Ungarn wurde sie zuerst von Bancsi (1971) gemeldet; er fand sie im Inundationsgebiet der Bodrog, aber nur in geringer Individuenzahl. Der Velenceer-See ist der zweite Fundort in Ungarn. Hier wurde sie im Moorauge des Schwimmoores in der Német-Lichtung am 16. VIII. bei einer Wassertemperatur von 22,8 °C gesammelt.

Lecane flexilis (Gosse, 1889)

Eine in kleineren – grösseren Gewässern nicht seltene Art. Sie lebt zwischen Pflanzen, bewegt sich sehr langsam und ist besonders klein. Vollkommene Länge beträgt 85 – 96 μ (Voigt, 1957).

Varga sammelte sie in Moospölstern bei Kőszeg (1936) und im Belső-See von Tihany (1937); im Balaton (1939) wird sie als individuenarme Art erwähnt. Im Kleinbalaton hingegen soll sie nach Varga (1944/45) sehr häufig und individuenreich sein. Ferner sammelte Varga sie noch in Bátorliget (1953), in der Őzberek-Quelle (1954) und im Szelidi-See (1959), wo sie selten, in submerser Vegetation angetroffen werden konnte. Kertész (1962) fand sie nur in einer Probe der Donau bei Mohács am 22. III. 1961. Ein Vorkommen im Velenceer See wurde zuerst am 21. VIII. in Moorauge des Schwimmoores neben dem Kuti-csapás festgestellt (Wassertemperatur 17,8 °C).

Lecane furcata (Murray, 1913)

(Abb. 4b)

In Ungarn wurde sie bisher nur von Varga im Kleinbalaton (1944/45) und von Bancsi (1971) am Ufer der Bodrog gesammelt. Sie kommt in seichten, mit Wasserpflanzen dicht besetzten, schattigen, ruhigen Gewässern vor. Der Velenceer See ist der dritte Fundort in Ungarn. Hier wurde sie im Moorauge des Schwimmoores neben dem Kuti-csapás am 21. VIII. bei einer Wassertemperatur von 17,8 °C gesammelt.

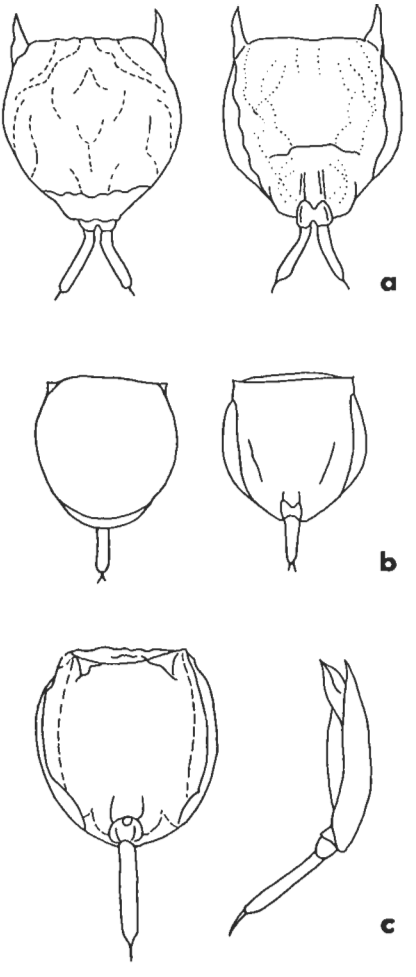

Abb. 4. Neue Rotatorienarten im Velenceer See. a: Dorsal- und Ventralpanzer von *Lecane arcula* HARRING; b: Dorsal- und Ventralpanzer von *Lecane furcata* MURRAY; c: Dorsal- und Ventralpanzer von *Lecane galeata* BRYCE

Lecane galeata (BRYCE, 1892)

(Abb. 4c)

Überall verbreitete, kosmopolitische Art, aber aus Ungarn wurde sie nur von zwei Stellen gemeldet. MEGYERI erwähnt sie aus dem Gyopáros-See (1965), BANCSI (1971) fand sie im Inundationsgebiet der Bodrog. Im Velenceer-See wurde ein Exemplar im offenen Wasser des Kuti-csapás am 10. IX. bei einer Wassertemperatur von 16,8 °C gesammelt. Obwohl sie als tychoplanktonische Art bekannt war, wurde sie hier im Plankton gefangen. Es ist anzunehmen, dass der starke Wind, der während der Probenahme herrschte, das Tier aus der Uferzone aufs freie Wasser trieb.

Rotaria neptunia (EHRB., 1832)

Kosmopolitische Art, die in geringer Individuenzahl anzutreffen ist. In der einheimischen Fauna häufig vertreten. VARGA erwähnt sie aus dem Neusiedler-See (1926), aus den Kubikgruben der Theiss (1928) aus Bátorliget (1953) und im Séd bei Aszófő (1957). Im Neusiedler See und im Séd soll sie eine seltene Art sein. MEGYERI wies sie in Totenarmen und Moorgewässern nach (1961, 1965). KERTÉSZ (1962) sammelte sie in Fliessgewässern. Sie ist für den Velenceer See nicht kennzeichnend, wurde im Moorauge neben der Német-Lichtung am 10. IX. in geringer Zahl erbeutet.

Neue Arten für die ungarische Fauna

Wir sehen von einer ausführlichen Beschreibung der Arten ab und charakterisieren nur das Vorkommen im Velenceer See.

Lecane inermis (BRYCE, 1892)

(Abb. 5a)

„Zwischen *Sphagnum*, in Tümpeln und Mooren, aber auch in grösseren Wasserbecken; in Thermalquellen und im Salzwasser "(VOIGT, 1957).

Der Velenceer See ist der erste Fundort in Ungarn. An zwei Stellen konnte sie gesammelt werden: im Moorauge neben der Német-Lichtung am 7. VIII. (Wassertemperatur 24 °C) und am 10. IX. im Plankton der Német-Lichtung (Wassertemperatur 18,6 °C). Die Verbindung der beiden Biotope wird auch durch das Vorkommen dieser Art bewiesen.

Masse nach VOIGT (1957): Länge 92 – 154 μ; Breite 22 – 42 μ; Länge der Zehen zusammen mit den Krallen 22 – 29 μ; Länge der Krallen 10 – 12 μ. Unsere Angaben liegen innerhalb der von VOIGT angegebenen Masse.

Lecane opias (HARRING & MYERS, 1926)

(Abb. 5b)

Nach Angaben der Literatur lebt sie vereinzelt in *Sphagnum* und Lebermoos. Im Norden allgemein verbreitet. Als zu erwartende Art wurde sie bisher in Ungarn nicht gesammelt. Der erste Fundort in Ungarn ist der Velenceer See. Im Wasser des Kuti-csapás wurde am 10. IX. ein Exemplar gesammelt (Wassertemperatur 16,8 °C).

	VOIGT (1957)	Velenceer See (1979)
Länge der Dorsalplatte	66 μ	67 μ
Ganze Länge	60 μ	63 μ
Länge der Zähen	28 μ	29 μ

Tabelle 1. Liste der an verschiedenen Fundorten angetroffenen Rotatorienarten

Arten	Nummer der Sammelstellen									
	1	2	3	4	5	6	7	8	9	
Anuraeopsis fissa (Gosse, 1851)	+	+	−	+	+	+	+	+	+	e
Asplanchna brightwelli Gosse, 1850	−	+	−	+	+	−	+	+	−	e
Asplanchna priodonta Gosse, 1850	−	−	−	+	+	−	+	+	+	e
Bdelloidea sp.	+	+	+	+	+	+	+	−	−	t
Brachionus angularis Gosse, 1851	+	+	+	+	+	+	+	+	+	e
Brachionus calyciflorus amphiceros (Ehrb., 1938)	−	−	−	−	−	−	+	+	+	e
Brachionus calyciflorus anuraeiformis Brehm, 1909	+	−	−	+	+	−	+	+	+	e
Brachionus calyciflorus dorcas (Gosse, 1831)	+	+	−	+	+	+	+	+	+	e
Brachionus plicatilis O. F. M., 1786	−	−	−	−	−	−	−	+	+	e
Brachionus quadridentatus Hermann, 1783	−	+	−	+	−	+	−	−	−	e, t
Brachionus quadridentatus brevispinus (Ehrb., 1832)	−	+	−	−	−	−	−	−	−	e
Brachionus urceolaris O. F. M., 1773	+	+	−	−	+	−	+	+	−	e
Cephalodella catellina (O. F. M., 1786)	−	−	+	+	+	−	−	−	−	t
Cephalodella gibba (Ehrb., 1832)	−	+	−	+	−	+	−	−	−	t
Colurella adriatica Ehrb., 1831	−	−	+	−	−	−	−	−	−	t
Colurella colurus (Ehrb., 1830)	+	+	+	+	+	+	+	−	−	t
Colurella uncinata deflexa (Ehrb., 1834)	−	+	−	−	−	−	−	−	−	t
Euchlanis deflexa (Gosse, 1851)	−	−	−	−	−	+	−	−	−	t
Euchlanis dilatata (Ehrb., 1832)	+	+	+	−	−	+	−	−	−	t
Filinia longiseta (Ehrb., 1834)	−	−	−	−	+	−	+	+	+	e
Keratella cochlearis (Gosse, 1851)	+	+	+	+	+	+	+	+	+	e
Keratella quadrata (O. F. M., 1786)	+	+	−	+	+	+	+	+	+	e
Keratella valga (Ehrb., 1834)	−	−	−	+	+	−	+	+	+	e
Lecane aculeata (Jakubski, 1912)	−	−	+	−	−	+	−	−	−	e
Lecane arcuata (Bryce, 1891)	+	+	−	−	−	+	−	−	−	t
Lecane arcula Harring, 1914	−	−	−	−	−	+	−	−	−	t
Lecane bulla (Gosse, 1886)	+	+	−	+	+	+	+	−	+	t
Lecane closterocerca (Schmarda, 1895)	+	+	+	+	+	+	−	−	−	t
Lecana flexilis (Gosse, 1889)	−	−	+	−	−	−	−	−	−	t
Lecane furcata (Murray, 1913)	−	−	+	−	−	−	−	−	−	t
Lecane galeata (Bryce, 1892)	−	+	−	−	−	−	−	−	−	t
Lecane inermis (Bryce, 1892)	−	−	−	−	+	+	−	−	−	t
Lecane luna (O. F. M., 1776)	+	+	−	+	+	+	+	+	+	t
Lecane lunaris (Ehrb., 1832)	+	+	−	+	+	+	+	−	+	t
Lecane opias (H. & M., 1926)	−	+	−	−	−	−	−	−	−	t
Lecane pyriformis (Daday, 1903)	−	+	+	−	+	+	−	−	−	t
Lecane undulata Hauer, 1938	−	−	+	−	−	+	−	−	−	t
Lepadella ovalis (O. F. M., 1786)	+	+	+	−	−	+	+	−	−	t
Lepadella patella (O. F. M., 1786)	+	+	+	+	−	+	−	−	−	t
Lophocharis oxysternon (Gosse, 1851)	+	+	−	+	+	+	+	−	−	t
Lophocharis salpina (Ehrb., 1834)	+	+	−	+	+	+	+	+	+	t
Mytilina mucronata (O. F. M., 1773)	+	+	−	+	+	−	+	−	+	t
Pedalia mira (Hudson, 1871)	+	+	−	+	+	+	+	+	+	e
Polyarthra major Burckhardt, 1900	+	+	−	+	+	+	−	+	−	e
Polyarthra vulgaris Carlin, 1943	+	+	+	+	+	+	+	+	+	e
Pompholyx complanata Gosse, 1851	+	+	−	+	+	+	+	+	+	e
Pompholyx sulcata Hudson, 1885	−	−	−	+	+	+	+	−	−	e
Rotaria neptunia (Ehrb., 1832)	−	−	−	−	−	+	−	−	−	t
Rotaria neptuniodes Harring, 1913	−	−	−	−	+	+	−	−	−	t
Rotaria rotatoria (Pallas, 1786)	−	−	−	−	+	+	−	−	−	t
Testudinella patina (Hermann, 1783)	−	+	+	−	−	+	−	−	−	t, e
Testudinella patina trilobata Anderson & Sephard, 1892	−	−	−	−	−	+	−	−	−	t
Trichocerca longiseta (Schrank, 1802)	−	−	−	−	−	−	+	−	+	e
Trichocerca rattus (O. F. M., 1776)	−	−	−	+	+	+	+	+	+	t
Trichocerca stylata (Gosse, 1851)	−	+	−	+	+	+	+	+	−	e
Trichotria pocillum (O. F. M., 1776)	−	−	−	−	+	+	−	−	−	t

Neue Art für die Fauna Europas

Lecane undulata HAUER, 1938

(Abb. 5c)

HAUER sammelte im Stausee in Java am 17. September 1928 seine Exemplare. Der See war 17 m tief, die Wassertemperatur an der Oberfläche betrug 27 °C, pH-Wert 8,2. GILLÁRD fand die Art am 15–16. August 1947 im Tanganjika-See.

Wir sammelten sie während unserer Untersuchungen im Velenceer-See bei zwei Gelegenheiten. Aus dem Moorauge neben dem Kuti-csapás am. 7. VIII., bei einer Wassertemperatur von 17,2 °C und vorausgehend am 24. VII. im Moorauge neben der Német-Lichtung, bei einer Wassertemperatur von 22 °C. Die bisher

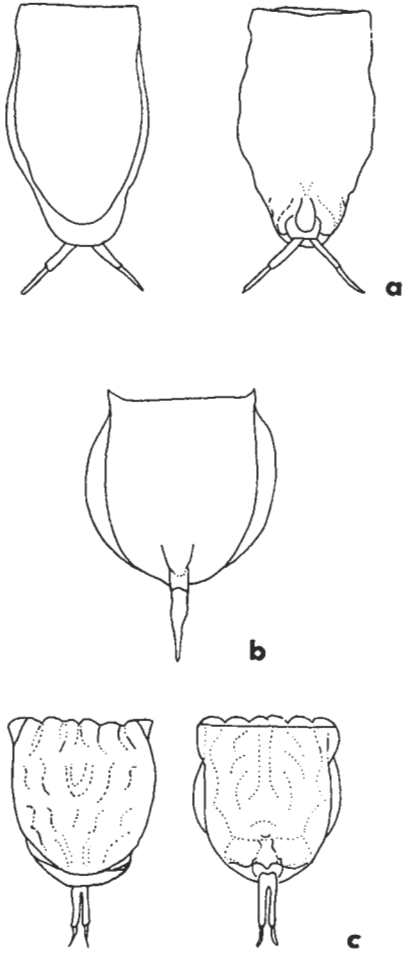

Abb. 5. Neue Rotatorienarten in Ungarn. a: *Lecane inermis* BRYCE in Dorsal- und Ventralansicht; b: Ventralpanzer von *Lecane opias* HARRING; c: Dorsal- und Ventralpanzer von *Lecane undulata* HAUER

bekannt gewordenen Fundorte im Velenceer See weisen darauf hin, dass es sich um eine Art mit engbegrenzten Biotopansprüchen handelt. Weitere Fundorte werden über die ökologischen Ansprüche wertbare Angaben liefern.

	Hauer (1938)	Velenceer See (1979)
Länge der Panzerplatte	51 μ	55 μ
Länge des Dorsalpanzers	48 μ	49 μ
Breite	44 μ	45 μ
Zähen und Krallenlänge zusammen	21 μ	23 μ
Krallenlänge	5 μ	5 μ

*

Über die Wertung der quantitativen und qualitativen Analysen des Rotatorienplanktons wird in der nächsten Arbeit berichtet.

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Die Bedeutung der Diplopodenart Chromatoiulus projectus Verh. bei der Zersetzung von Eichenstreu

Von

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Abstract. Under particular cave-laboratory conditions, feeding experiments were carried out to estimate, quantitatively, the litter consumption activities of *Chromatoiulus projectus* (Diplopoda), one of the most frequent millipede species in the litter layers of Hungarian forest stands. The adult specimens of this species were fed on weathered fallen leaves of *Quercus petraea* sampled monthly in a forest sampling site during the feeding experiments. The amount of the consumed leaf material averaged to about 730 mg per one living animal per 9 months (one year minus the winter period). The quantity of the produced fecal pellets and of the consumed leaf matter showed a direct correlation as it was proved by statistical analyses. The fluctuation found in feeding activities may be trace back to the differing chemical composition of the weathered leaf material added but other unknown factors could also play a role.

Die Erkundung von Zersetzungsporzessen der Laubstreu, die im Stoff- und Energiekreislauf der Wälder von ausschlaggebender Bedeutung sind, gehören auch in Ungarn derzeit zu den wichtigsten bodenzoologischen und ökologischen Problemen. Die bisherigen ernährungsökologischen Untersuchungen zeigten bereits, dass den saprophagen Bodentieren – wie Lumbriciden, Enchytraeiden, Isopoden und Diplopoden – eine verschiedene aber doch bemerkenswerte Rolle bei diesen Prozessen zugemessen werden kann.

Die beiherigen Untersuchungen erfolgten in Hainbuchen-Eichenbeständen, wobei den sich leichtzersetzlichen Laubarten, wie Hainbuche und Linde der Vorrang gegeben wurde. Da jedoch in diesen Beständen auch mit einem bedeutenden Anteil (36%) von schwerzersetzlichen Laubarten gerechnet werden muss, zeigte es sich von Interesse die Zersetzlichkeit dieser ebenfalls zu verfolgen. Es wurde zum Ziel gesetzt, das Fallaub der in den ungarischen Waldbeständen mit 13% vertretenen Traubeneiche (*Quercus petraea* Mett.) mit der Diplopodenart *Chromatoiulus projectus* Verh., die in Ungarn grosse Verbreitung besitzt, hinsichtlich ihrer Frasstätigkeit zu prüfen, wobei der Konsum des in verschiedenem Rottezustand befindlichen Laubes verfolgt werden sollte.

Untersuchungsmethode

Die Fütterungsversuche wurden in ausgebrannten, unemailierten Tongefässen (Gere, 1958) durchgeführt. Um die Durchlüftung der Gefässe zu sichern, wurden diese mit einem Nylonnetz abgedeckt. Die Tiere und die Laubstreu der

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Traubeneiche wurden aus einem Waldbestand des Vértes-Gebirge, der als Versuchsbestand diente, gesammelt. Da bekannterweise die streuzersetzenden Bodentiere das verrottete Fallaub mit verschiedener Intensität konsumieren, wurde die Streu monatlich eingesammelt und verabreicht.

Die Tongefässe erhielten je 2 g Blattsubstanz (in abs. Trockengewicht) berechnet, das nachträglich angefeuchtet wurde. In jedem Gefäss wurden ferner noch je 5 adulte Tiere, deren Lebendgewicht vorausgehend bestimmt wurde, untergebracht. Die verabreichte Blattsubstanz wurde monatlich gewechselt, wobei das Lebendgewicht der Tiere gewogen, die Kotproduktion und der Konsum bestimmt (abs. Trockengewicht).

Gleichzeitig wurden in entsprechenden Kontroll-Gefässen die von der Mikroflora- und Fauna verursachten Zersetzungsverluste bestimmt.

Die Untersuchungen wurden unter optimalen Verhältnissen, im höhlenbiologischen Laboratorium der Baradla-Höhle in Aggtelek durchgeführt. Die ständige Temperatur der Höhle beträgt 10 ± 1 °C, die relative Luftfeuchtigkeit ist ebenfalls ziemlich ausgeglichen und beträgt $98 \pm 1\%$. Diese Werte eignen sich vorzüglich zur Durchführung von ernährungsökologischen Untersuchungen verschiedener Bodentiere.

Die Versuche wurden im März 1977 begonnen und endeten im April 1978. Da sich die Tiere in den Wintermonaten bei grösserer Kälte in tieferen Bodenschichten aufhalten, wurde die Streu der Monate Dezember, Januar und Februar nicht verfüttert.

Die Versuche wurden in je 5 (gelegentlich je 10) Parallelen und mit ebensovielen Kontroll-Versuchen durchgeführt.

Der Konsum der Tiere wurde mit Hilfe der Formel nach REIMAN (ZICSI & POBOZSNY, 1977) berechnet, die Angaben beziehen sich auf 1 g Lebendgewicht der Tiere in mg/Tag.

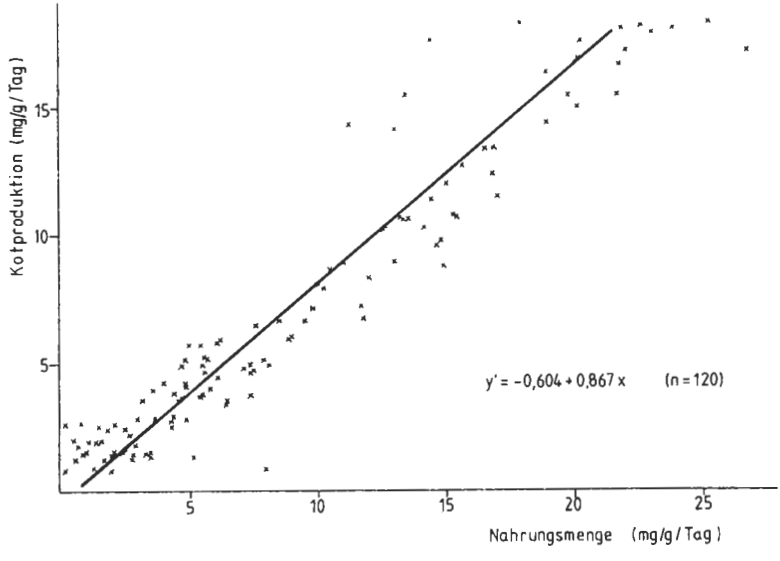

Abb. 1. Kotproduktion in Beziehung der Nahrungsmenge bei der Diplopoden-Art *Chromatoiulus projectus*

Um feststellen zu können, ob die Frassintensität von der jeweiligen chemischen Zusammensetzung der Laubstreu beeinflusst wird, wurden die zur Verfütterungen gelangenden Blätter bezüglich ihrer chemischen Komponente analysiert. Zur Bestimmung der chemischen Komponente wurden die in der bondenkundlichen Praxis üblichen Methoden angewandt (SCHLICHTING & BLUME, 1966). Bei den einzelnen Analysen wurde der Gesamtgehalt der organischen Substanz, der des Stickstoffes, von den verschiedenen Komponenten der organischen Substanz Fette und Gerbstoffe, Zucker und Stärke, Pektin und Hemizellulose sowie die Zellulose bestimmt.

Beim Nachweis der Zusammehänge wurden Regressions- bzw. Korrelationsberechnungen durchgeführt (SVÁB, 1967).

Wertung der Ergebnisse

Die Konsumwerte von *Chromatoiulus projectus* sowie die Werte der Losungproduktion werden in Tabelle 1 zusammengefasst.

Wie dies aufgrund vorausgehender Untersuchungen sowie anhand der bekannten Literaturangaben zu erwarten war, wurde von der Traubeneichen-Streu mit Vorschreiten des „Alters", d.h. proportionell mit der nach dem Laubfall vergangenen Zeit, ständig steigende Mengen verzehrt.

Beim hohen Konsum der Traubeneiche im Mai kann im Juni ein starker Rückgang verfolgt werden. Eine stichhaltige Erklärung für diesen Rückgang der Frasstätigkeit können wir derzeit nicht liefern, eine ähnliche Erscheinung konnte bei Enchytraeiden DÓZSA-FARKAS (1982) – ebenfalls bei Untersuchungen im höhlenbiologischen Laboratorium – beobachten.

Tabelle 1 enthält auch die Werte der Losungproduktion. Bereits DUNGER (1958) konnte feststellen, dass zwischen der Nahrungsintensität und der Losungproduktion der Diplopoden eine lineare Proportion besteht. Diese Aussagungen werden auch durch diese Untersuchungen unterstützt, wobei zwischen dem konsumierten Laub und der Menge der erzeugten Exkremente eine signifikante (P = 0,1% Wahrscheinlichkeit) lineare Korrelation besteht (Abb. 1.)

Die Zusammenhänge aufgrund der Regressionsanalyse sind die folgenden:

$$Y' = -0{,}604 + 0{,}867x \qquad (n = 120)$$

Die Bedeutung der Variablen in der Gleichung: x = Menge der konsumierten Nahrung; Y' = Menge der Exkremente, die aus der konsumierten Nahrung erzeugt wurden.

Um die Konsum und Losungsangaben werten zu können und sie mit Literaturangaben vergleichen zu können, müssen sie auf ein Tier bezogen werden. Zu diesem Zweck musste das Durchschnittsgewicht eines lebenden ausgewachsenen Tieres bestimmt werden. Das Lebendgewicht eines adulten *C. projectus* wurde anhand von 389 Messungen bestimmt. Dies beträgt $1{,}926 \times 10^{-1}$ ($\pm$ $5{,}056 \times 10^{-2}$)g.

In Tabelle 2 wird der Konsum und die Menge der erzeugten Exkremente eines Tieres pro Tag, bzw. pro Monat angeführt. Die Differenz zwischen dem täglichen Konsum und der täglich erzeugten Exkremente weist auf die Menge des täglichen Nahrungsbedarfes hin. Der tägliche Nahrungsbedarf eines Tieres schwankt zwischen 0,02 mg und 0,92 mg, ist im Frühjahr und Anfang des Herbstes am höchsten, am niedrigsten Ende des Winters, am Anfang des Frühjahrs und

auch im Spätherbst, obwohl diese Menge im Prozent der konsumierten Nahrung ausgedrückt die höchsten Werte aufweist (Abb. 2).

Meine Angaben fügen sich den von GERE (1962a, 1962b, 1965) anhand verschiedener Fütterungsversuche erlangten Ernährungswerten an. GERE verfütterte ebenfals Traubeneichen-Streu mit *C. projectus*, wobei ein Jahr hindurch gelegenes, dunkelbraunes bzw. verpiltztes Laub den Tieren angeboten wurde. Seine Ergebnisse bei Freilandsuntersuchungen (1962b) – insofern nur die Werte der adulten Tiere berücksichtigt werden – erbrachten auf ein Individuum bezogen in der Zwischenzeit von Juni bis Oktober einen Konsumnachweis von 0 – 5,14 mg pro Tag, dies beträgt 0 – 1,45% des Lebendsgewichtes. Die von GERE (1962a) unter Laborverhältnissen durchgeführten Versuche wiesen einen Konsum von 0,21 – 9,28 mg auf, während die von ihm (1965) im höhlenbiologischen Laboratorium durchgeführten (meinen Versuchen am nähesten stehenden) Untersuchungen 1,30 – 4,11 mg Werte des täglichen Konsums aufwiesen. Dies macht im Falle von GERE 0,90 – 2,75% des Lebensgewichtes aus, bei meinen Versuchen 0,23 – 2,80%.

Obwohl GERE das ganze Jahr fortlaufend dieselbe Streu verfütterte, erhielt er trotzdem extreme Werte im Konsum, und zwar mit meinen Beobachtungen übereinstimmend im Mai die höchsten, im November und Dezember die niedrigsten.

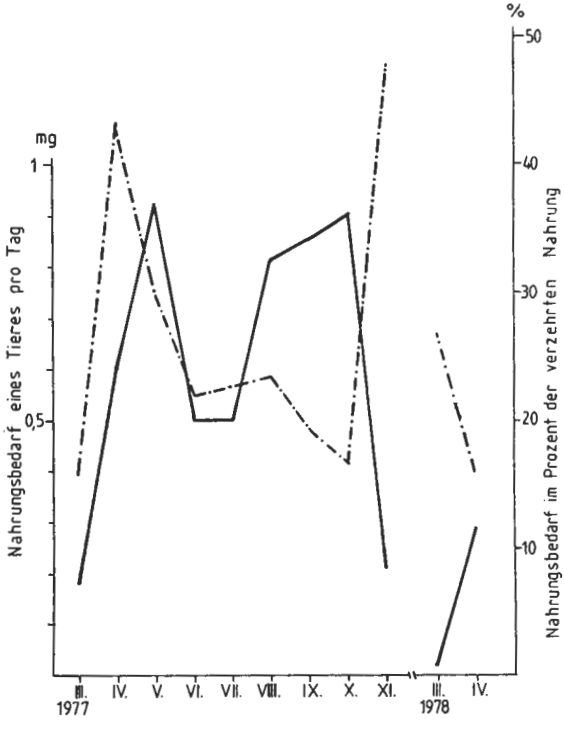

Abb. 2. Nahrungsbedarf der Art *Chromatoiulus projectus* von der in verschiedenen Monaten gesammelten Laubstreu. Nahrungsbedarf eines Tieres pro Tag (–). Nahrungsbedarf im Prozent der verzehrten Nahrung (– · –).

Mit recht kann also die Frage, welche Faktoren die Konsumintensität von *C. projectus* beeinflussen, erhoben werden. Die im höhlenbiologischen Laboratorium unter Ausschliessung der Umweltsfaktoren durchgeführten Untersuchungen weisen auf die Möglichkeit hin, dass diese Eigenschaften eventuell genetisch determiniert sein können. Die Versuchsergebnisse von GERE scheinen diese Anschauung zu unterstützen. Aber auch die Qualität der Nahrung, wie dies zahlreichen Literaturangaben zu entnehmen ist (LYFORD, 1943; DUNGER, 1958; THIELE 1959; EDWARDS und HEATH, 1963; EDWARDS, 1974; SAKWA, 1974), ist ein die Konsumintensität beeinflussender Faktor.

Um der letzteren Frage näher kommen zu können, wurden chemische Analysen des zur Nahrung angebotenen Substrates durchgeführt (Tab. 3). Zwischen der Menge der chemischen Komponente und der Ernährungsintensität konnte keine engere Korrelation nachgewiesen werden. Bloss bei P = 10% Wahrscheinlichkeit zeigte sich ein Zusammenhang zwischen dem Gehalt der organischen Substanz, bzw. der Fette und Gerbstoffe, ferner dem wasserlöslichen Kohlenstoff und dem Nahrungsverbrauch der Tiere. Die übrigen untersuchten Komponente scheinen überhaupt keinen Einfluss auf die Frassintensität auszuüben. Der vielfältigen chemischen Zusammensetzung des Ausgangsmaterials zufolge können auch andere, bisher unberücksichtigte Komponente der Laubstreu als Konsumintensität beeinflussende Faktoren in Frage kommen. Es müssten weitere komplexe Untersuchungen durchgeführt werden, wobei u.a. auch die Vermehrungsbiologie der Tiere weitgehend berücksichtigt werden muss.

Abgesehen von den oben erwähnten Problemen, war die eigentliche Zielsetzung meiner Untersuchungen festzustellen, welche Rolle die Diplopodenart *C. projectus* beim Abbau des Eichenlaubes spielt. Wie aus Tab. 2 ersichtlich, beträgt der jährliche (von März bis November) Konsum eines Tieres rund 730 mg. Die von uns errechneten Angaben bedeuten in der Praxis in natürlichen Waldbeständen folgenden prozentuellen Anteil.

In unserem Versuchsgelände bei Szendehely – Katalinpuszta, in einem Hainbuchen – Eichenbestand wurde aufgrund der Aufsammlungen 1971 – 1977 eine durchschnittliche Laubstreuproduktion von 2880 kg/ha berechnet, die Eiche ist hier mit 986 kg/ha vertreten. Wie bekannt (ZICSI, 1975), wird hier die Zersetz-

Tab. 1. Werte des Konsums und der Losungproduktion von Chromatoiulus projectus bei Verfütterung der Traubeneiche (Quercus petraea)

Laubstreu der Monate	Konsum mg/g/Tag	Losung mg/g/Tag
März 1977	5,9 ± 2,2	5,0 ± 1,3
April	7,2 ± 0,5	4,1 ± 0,6
Mai	16,0 ± 3,6	11,2 ± 3,5
Juni	11,8 ± 4,0	9,2 ± 3,4
Juli	11,5 ± 2,0	8,9 ± 2,4
August	18,0 ± 5,6	13,8 ± 4,6
September	23,0 ± 4,4	18,6 ± 3,2
Oktober	28,0 ± 8,1	23,3 ± 6,4
November	2,3 ± 0,3	1,2 ± 0,3
März 1978	3,9 ± 1,8	3,8 ± 0,6
April	9,5 ± 5,1	8,0 ± 4,9

Tab. 2. Nahrungsbedarf eines C. projectus-Individuums von der in verschiedenen Monaten gesammelten Laubstreu

Laubstreu der verschiedenen Monate	Konsum 1 Tieres pro Tag in mg	Losung-produktion 1 Tieres pro Tag in mg	Nahrungsbedarf 1 Tieres pro Tag in mg	Konsum 1 Tieres pro Monat in mg
März 1977	1,14	0,96	0,18	35,34
April	1,39	0,79	0,60	41,70
Mai	3,08	2,16	0,92	95,48
Juni	2,27	1,77	0,50	68,10
Juli	2,21	1,71	0,50	68,51
August	3,47	2,66	0,81	107,57
September	4,43	3,58	0,85	132,90
Oktober	5,39	4,49	0,90	167,09
November	0,44	0,23	0,21	13,20
März 1978	0,75	0,73	0,02	23,25
April	1,83	1,54	0,29	54,90

Tab. 3. Chemische Zusammensetzung der zur Verfütterung angebotenen Traubeniechen-Streu

Laubstreu der verschiedenen Monate	Gesamt organische Stoffe	Gesamt Stickstoff	Fette und Gerbstoffe	Zucker und Stärke	Hemi-zellulose und Pektin	Zellulose
	%					
März 1977	92,56	–	8,48	0,86	7,40	7,30
April	91,45	–	7,80	1,91	7,14	7,25
Mai	89,28	1,95	7,28	0,75	5,52	4,47
Juni	89,10	2,00	7,22	0,23	5,02	3,38
Juli	89,17	–	6,13	0,31	6,32	6,33
August	84,99	2,08	5,12	0,54	7,09	4,38
September	86,33	2,20	5,57	0,26	5,98	2,41
Oktober	88,91	1,96	6,04	0,48	5,89	4,71
November	92,78	0,70	7,72	3,06	–	–
März 1978	91,41	1,19	8,42	2,50	–	–
April	90,27	–	7,40	1,60	–	–

ung der Laubstreu von grosskörprigen Lumbricidenarten gesteuert. Die Individuendichte von *C. projectus* beträgt 1,6 – 3,2 pro m². (Loksa, 1977). Der Eichenlaubkonsum dieser Art macht jährlich 0,6 – 0,8% vom Gesamtfallaub aus, auf die Eiche bezogen beträgt dies 1,18 – 2,35%. Im anderen Versuchsbestand unserer Forschungsgruppe, ebenfalls in einem Hainbuchen-Eichenbestand im Vértes-Gebirge, wo im Gegensatz zum vorherigen Standort grosskörprige Regenwurmarten fehlen, kann den Vertretern der saprophagen Makro- und Mesofauna eine bedeutendere Rolle bei den Abbauprozessen der Laubstreu zugemessen werden. Hier beträgt die durchschnittliche Laubstreuproduktion, ebenfalls aufgrund der Aufsammlungen von 1971 – 1977 berechnet, im Durchschnitt 2664 kg/ha, die der Eiche 993 kg/ha. Die Individuendichte von *C. projectus* beträgt 6,4 – 12,8 pro m² (Loksa, 1977), d.h. der jährliche Konsum dieser Art vom Gesamtfallaub

liegt zwischen 1,75 – 3,50%, von der der Eichenstreu zwischen 4,7 – 9,4%. In einem weiteren von uns untersuchten Waldbestand, im Bükkgebirge (Síkfőkút-Projekt), dessen durchschnittliche jährliche Fallaubproduktion 3903 kg/ha beträgt und wo die Streuproduktion von *Q. petraea* 56,5 – 65% der Gesamtstreuproduktion ausmacht (Tóth, 1979) und wo ebenfalls keine grosskörprigen Regenwurmarten vorkommen, beträgt die Individuendichte von *C. projectus* 16 – 32 (Székelyhidy & Loksa, 1979). Der Konsum dieser Art beträgt hier 3 – 6% vom Gesamtfallaub, von der Eiche 4,47 – 10,57%.

Natürlich verzehren die Individuen der Art *C. projectus* nicht nur Eichenlaub, sondern auch die Streu anderer Bäume bzw. Straucharten sowie die Streu des Untergewächses. Über die Rolle dieser Art in einem Waldbestand bzw. über das Ausmass der Streuzersetzung werden weitere komplex durchgeführte Nahrungspreferenz und die Nahrungsmenge bestimmende Untersuchungen aufschluss geben.

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The Diet Niche Relationships of the Great Tit (Parus major) and Blue Tit (Parus caeruleus) Nestlings in an Oak Forest

By

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Abstract. The food composition of the nestlings of the great tit and blue tit was studied based upon 927 and 183 samples, respectively (one sample: food of one nestling per hour), in a mixed oak forest near Budapest. The main food type of both species was the Lepidoptera larva, followed by much smaller quantities of spiders. The greatest amount of spiders was consumed at the early stage of development of the nestlings. Niche breadth calculated for food composition and prey size distribution is wider in case of the great tit suggesting a more generalistic feeding habit of this species. Habitats of the prey animals of both species are very similar. Food niche segregation seems to be the greatest in the dimension of taxonomic composition of food.

The great tit *(Parus major)* and blue tit *(Parus caeruleus)* are characteristic breeding species of the bird communities of temperate deciduous forests. Due to their good adaptive ability and high abundance they can be found even in areas beyond their optimal habitats (pinewoods, parks). Especially the great tit settles in the human evironment besides its natural habitats. Because of their wide distribution and high density both *Parus* species have been studied intensively. The researchers of the Edward Grey Institute of Oxford have continously been investigating the feeding ecology (HARTLEY, 1953; GIBB, 1954; BETTS, 1955; GIBB & BETTS, 1963; ROYAMA, 1970), the population dynamics (LACK, 1958; KREBS, 1971) and behaviour (KREBS & al., 1977) of the tits. The works of the Dutch KLUJVER (1950), TINBERGEN (1960) and BALEN (1973), as well as that of the Belgian DHONDT (1977) ave also closely connected with the tits.

This paper deals with the nutrition quality and quantity of the nestlings of great- and blue tits in a mixed oak forest which can be considered their optimal habitat. The aim of the study was a comparison between the two species considering their feeding habits first of all taxonomic composition and size distribution of their prey and foraging site preference of birds. Such studies may contribute to a better knowledge of the interspecific relationships of *Parus major* and *P. caeruleus*.

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Methods

The study area was a mixed oak forest near Budapest. Its dominant tree species is *Quercus cerris*, in a smaller quantity *Q. petraea*, *Carpinus betulus*, *Acer campestre* and *Cerasus avium* also occur. The most frequent shrubs are *Crataegus* spp., *Ligustrum vulgare*, *Rosa* spp., *Sambucus nigra*. The forest was bordered by an apple orchard from the south. In a 12 *ha* part of the forest chosen as examination area 40 artificial nesting holes were placed.

Food samples were collected from the great- and blue tit nestlings during the breeding periods 1978 and 1980 with the "neck collar" method. The mucous coating of the samples was washed off with water, then the food was stored in 70 per cent isopropyl alcohol until determination. If one hour's food of one nestling is considered 1 food sample, then in 3 years 927 samples were collected from the great tit and 183 ones from the blue tit. In the case of the blue tit the number of the samples was less because this species bred in the artificial holes in a much smaller number of individuals than the great tit.

When elaborating the data, the niche breadth and the niche overlap between the two species was calculated on the basis of taxonomic composition and prey size distribution as 2 special, hypothatical niche components. When calculating the value using the taxonomic composition of the food samples were pooled to families.

Niche breadth was calculated by SIMPSON's (1949) formula which was suggested by LEVINS (1968) for determining niche breadth:

$$B = 1 \Big/ \sum_{i=1}^{s} p_i^2$$

The niche overlap between the two species was calculated by RENKONEN's (1938) similarity index:

$$C_{hj} = 1 - 1/2 \sum_{i} p_{hi} - p_{ji}$$

In calculations of food taxonomic composition p_i is the frequency of food group i (mostly family) in the food (s: the number of food groups). In calculations of size distribution p_i is the proportion of the number of individuals belonging to the size class i in the food (s: the number of size classes). h and j specifies the great tit and bule tit, respectively.

Calculations on the foraging site of the great- and blue tits were drawn from the habitats of the prey animals. The habitats of some of the prey was difficult to determine exactly, therefore it was their most probable habitats that were taken as a basis. In this way 6 foraging sites were distingwished (Fig. 2). Since this method enables only rough and indirect determination of the prey habitats, this third possible niche component was not considered during the calculations of niche breadth and overlap.

Results

In the diet of the great tit nestlings a total of 63 species, from that of the blue tit nestlings 24 species were found (Appendix 1 and 2). Numerous individuals could only be determined as genera or families. The dominant food type of both

species was the Lepidoptera larvae, which, on an avarage of 3 years, amounted to 63,3% of the total food of the great tit and to 74,0% of that of the blue tit, both measured in dry weight. The largest amount of caterpillar food consumed by the great tit consisted of *Colotois pennaria, Amphipyra pyramidea, Orthosia* spp. and *Drymonia chaonia*. Among this prey type of the blue tit *Orthosia* spp., *Colotois pennaria* and the small-sized *Tortrix viridana* were significant. Lepidoptera adults were found in the diets of both species, Lepidoptera pupae only in that of the great tit. In the other important food group, the spiders, the majority of *Xysticus lanio* and *Philodromus aureolus* were observed in case of both tit species. *Araneus cucurbitinus* and *Xysticus ulmi* were found in the food of the blue tit, while the soil inhabiting *Pisaura mirabilis* and *Alopecosa* spp. were found in the food of the great tit. Diptera were significant only in the diet of the great tit nestlings.

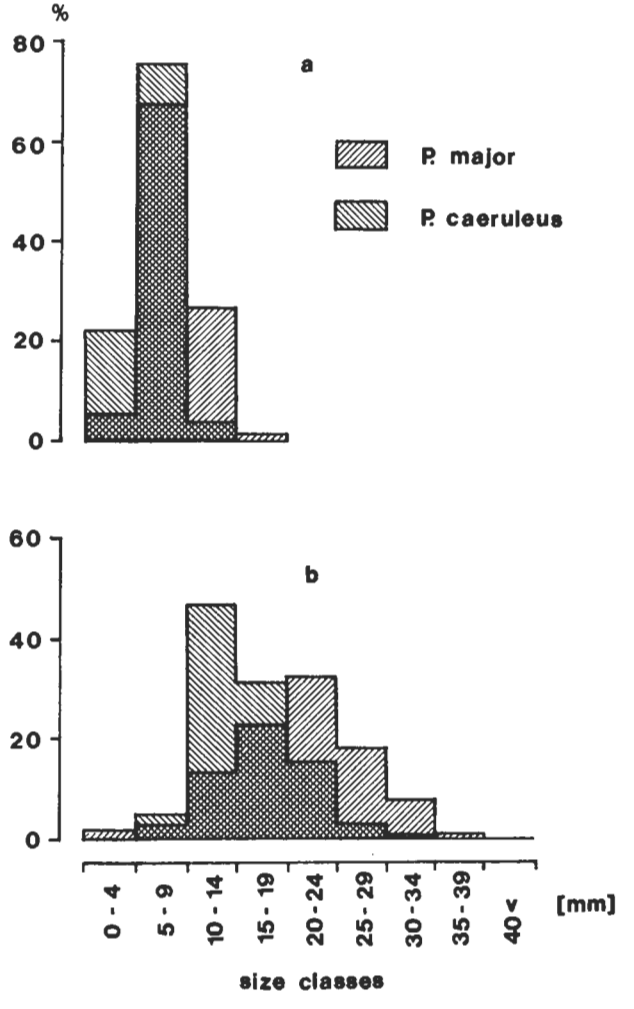

Fig. 1. Size distribution of spiders (a) and caterpillars (b)

Especially *Tipula* species (mainly females carrying eggs and therefore moving slowly) were consumed in large amounts in certain periods. The other food groups (see Appendix 1 and 2) were found only in small quantities and in certain years, in case of both bird species. In numerous food samples snail shells and grit occured as grinding material.

Table 1. Niche breadth of the great- (Pm) and blue (Pc) tit (B-samples of the three years are pooled; + sample size)*

	1978		1979		1980		B*	
	Pm (15)+	Pc (32)	Pm (578)	Pc (42)	Pm (334)	Pc (119)	Pm (927)	Pc (193)
Prey taxon	3.52	4.95	6.05	2.87	4.84	3.97	5.90	5.68
Prey size								
spider	1.80	1.47	2.23	1.20	1.53	1.71	1.90	1.63
caterpillar	2.08	2.86	4.66	3.93	4.62	2.31	4.77	2.98
total prey	3.81	3.41	7.37	4.67	5.55	3.91	5.52	4.29

Table 2. Niche overlap of the great- and blue tit (C_{hj}-samples of the three years are pooled)*

	1978	1979	1980	C_{hj}*
Prey taxon	0.38	0.61	0.70	0.59
Prey size				
spider	0.53	0.69	0.71	0.75
caterpillar	0.55	0.88	0.42	0.57
total prey	0.83	0.69	0.60	0.72

The total niche breadth values (B*) were similar but sharp yearly differences were obtained between the two species (Tab. 1). Neither breadths nor similarity indices were evaluated in the case of 1978 data because of the low sample size. Food composition niche breadth values of the great tit were higher than those of the blue tit in both 1979 and 1980.

The analysis of measurements performed in the two dominant food groups, in caterpillars and spiders, led to the following results (Fig. 1). In its majority, the great tit consumed the caterpillars of 20 – 24 mm, the blue tit the ones of 10 – 14 mm. In the case of spiders, specimens of 5 – 9 mm size dominated the food of both bird species.

Niche breadth calculated from the size distribution of the caterpillars and the total prey amount was greater in case of *P. major* than of *P. caeruleus* in both years (Tab. 1). Food composition niche overlap was lower than the value obtained on the basis of prey size. Size distribution of spiders (C_{hj}*) in the food of the two tit species was more similar than that of the caterpillars (Tab. 2, Fig. 1).

In the breeding period the most important foraging site of both tit species was the tree foliage (Fig. 2). From this prey habitat type the blue tit's food portion was higher than the one of the great tit. On the other hand, with the quantity of food picked up from the soil and from the grass, the great tit surpassed the blue tit.

In the development of the nestlings the stages presented in Fig. 3 were distinguished. The greater part of the food of the 1—3 days old great tit nestlings was caterpillars (29,8%), Diptera (25 5%) and spiders (24 0%). The proportion

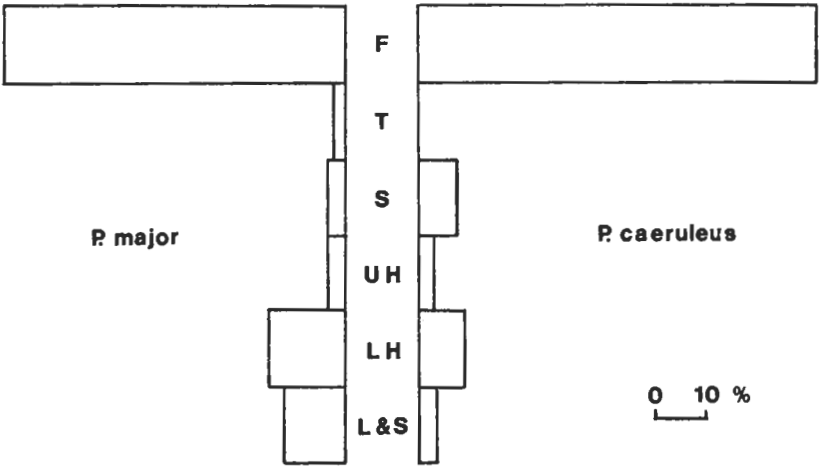

Fig. 2. Foraging sites of the great- and blue tit (L & S — leaf litter and soil, LH — lower herb, UH — — upper herb, S — shrub, T — trunk, F — foliage)

of caterpillars gradually increased during development, and reached 83 7% by the time of leaving the nest. The proportion of spiders decreased to 8,3% from the initial 24,0% while that Diptera fell from 25,5% to 1,1%. The other animals groups (Lepidoptera adults and pupae, Coleoptera, Hymenoptera, Homoptera, etc.) were found only a small quantities. Among grinding materials insignificant proportions of grit and snail shells occured in each stage of development.

The food composition of the blue tit nestlings showed similar trends (Fig. 3). By the time of leaving the nest, the proportion of the caterpillars increased to 90,1% from the initial 54,7%. In every stage of development — except the third one — the nestlings of the blue tit consumed more caterpillars than those of the great tit. Similarly, the proportion of the spiders was high (23,6%) in the early stage of development, later it decreased (9,9%). Diptera were found in blue tit nestlings in the first three stages of development, however then their proportion was not significant. The other animal groups and the grinding materrial occured irregularly.

The analysis of the monthly changes in food composition was carried out in 1979 and 1980 only for the great tit (Appendix 2). The diet of the nestlings showed the widest variety in May. Species of 28 and 12 food groups were found in the food samples in 1979 and 1980, respectively. In June the food consisted of species of 20 and 10 groups, respectively, and in July 1980 species of only 9

groups. The proportion of Lepidoptera larvae was high in all the three months the highest value was obtained in July. Out of the caterpillars, the proportion of Noctuidae gradually increased in the breeding period, on the other hand the one of Geometridae decreased. Lepidoptera adults were present in the food of the nestlings mainly in May, and their pupae in all three months. *Tipula* species (Diptera) were found only in May samples but their proportion was high in this month. The proportion of other groups of Diptera was low both in May and in June; by July they vanished from the diet entirely. The frequency of the spiders was even during the whole breeding period, although their species composition varied in the different months. Thus e.g. *Alopecosa* spp. were present only in May food samples, *Philodromus aureolus* only in June and *Xysticus lanio* in all three months.

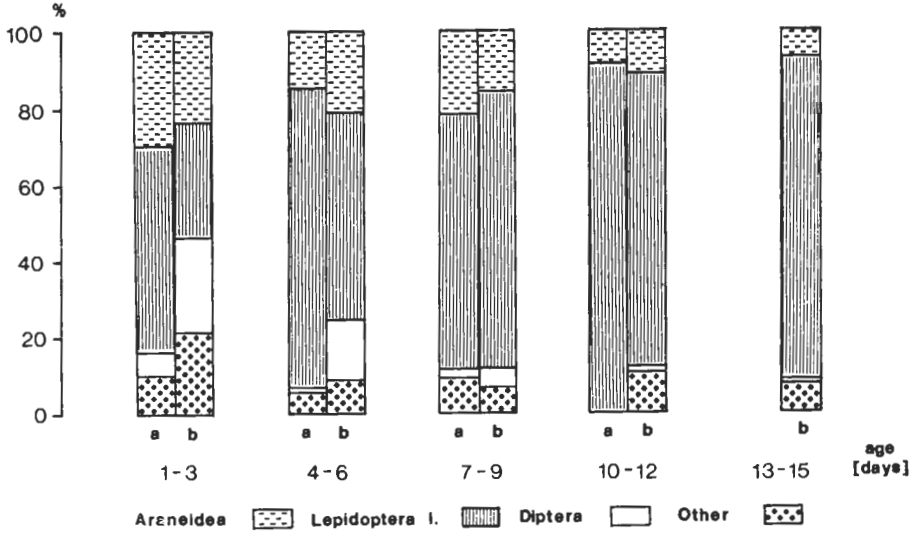

Fig. 3. Food composition of the nestlings of great- (a) and blue tit (b) in five developmental stages

Discussion

According to feeding studies conducted in various habitats, the most important food of the great- and blue tit was the Lepidoptera larva (Betts, 1955; Gibb, 1954; Gibb & Betts, 1963; Royama, 1970; Tinbergen, 1960). My own results also show that in a mixed oak forest both species mainly consum caterpillars. The proportion of caterpillars increased with the advance of the breeding period and with the progress of the nestlings' development even if there is a second brood. The species richness of caterpillar food of the great tit was higher than the one of the blue tit. Royama (1970) found similar proportion and species composition of Lepidoptera larvae in the food of the great tit in a mixed oak forest. In pure oak forests and in pine forests, the caterpillar diet of the tits is much less rich in species, generally it is composed of only a few superabundant species (e.g. *Operophtera brumata* and *Tortrix viridana* in oak forests and *Panolis flammea* in pine forests – Betts, 1955; Gibb & Betts, 1963; Balen, 1973).

The blue tit consumed the greatest amount of caterpillars of 10 – 14 mm, the great tit those of 20 – 24 mm in length. Other studies (BETTS, 1966; GIBB & BETTS, 1963; BALEN, 1973) reported preference of smaller animals in the diet of both species. The difference is caused presumably by the fact that these authors conducted their examinations in pure stands, where the above mentioned caterpilars (all are of small size) were characteristic.

Due to their low chitin content and easy digestibility, the spiders are important in the earlier stage of the nestling development (BETTS, 1955; ROYAMA, 1970), yet they can continuously be found in the diet even later. In the diet of the great tit ROYAMA (1970) found a smaller proportion of spiders in an oak forest, TINBERGEN (1960) a higher in a pine forest than did the present study. The size of the spiders in the diet of the two tit species was very similar.

The other animal groups were present in the food samples temporarily, probably according to the changes in their abundance in the environment.

The results show that the great tit, because of its higher niche breadth values, is less specialised in terms of feeding than the blue tit. This is probably one of the reasons why the great tit settles more often in less advantageous habitats.

Referring to the examinations of GIBB (1954) and BETTS (1955), DHONDT (1977) supposes that in the breeding period the diet niche of the blue tit is wider than the one of the great tit. According to his explanation, the blue tit can search for food on both the thinner and thicker branches while the great tit only on the thicker ones. On the other hand, 41% of the blue tit's food cannot be found in the food of the great tit while only 7% of the great tit's food is not contained in the food of the blue tit. In the present study these values are 29% and 60%, respectively, which also seems to prove a wider diet spectrum of the great tit.

Foraging sites as well as prey size distribution of the two species showed high overlap. Comparing the size distribution of only the caterpillars and the spiders, the overlap is smaller in the latter group. Therefore prey taxon seems to be the most important factor in the food segregation of the great tit and blue tit.

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Appendix 1. Food composition of the blue tit nestlings (percentage values given in dry weight)

Taxa	1978		1979		1980		Total (three years)		
	n	%	n	%	n	%	g dry wt	n	%
Heteroptera									
Miridae larva indet.					17	0.84	0.0105	17	0.31
Coleoptera									
Cerambycidae									
Cortodera humeralis	1	0.31			4	1.52	0.0300	5	0.72
Chrysomelidae									
Pyrrholta viburni					1	0.59	0.0089	1	0.22
Melolonthidae									
Miltotrogus aequinoctialis	3	0.67					0.0150	3	0.36
Coleoptera indet.	3	1.33					0.0294	3	0.71
Lepidoptera									
Tortricidae indet.					2	1.32	0.0200	2	0.48
Lepidoptera larvae									
Tortricidae									
Tortrix viridana	16	22.64					0.4600	16	13.08
Tortricidae indet.	2				3	2.64	0.0830	5	

Appendix 1 (Cont.)

Taxa	1978		1979		1980		Total (three years)		
	n	%	n	%	n	%	g dry wt	n	%
Noctuidae									
Orthosia stabilis			1		8		0.1006	9	
Orthosia schmidtii		9.99		52.61	5	14.58	0.0550	5	15.80
Orthosia spp.	1		17		4		0.2567	22	
Noctuidae indet.	7		1				0.1990	8	
Geometridae									
Colotois pennaria			2		31		0.3977	33	
Operophtera brumata					16		0.1025	16	
Erannis defoliaria	2	25.69		22.57		42.73	0.0350	2	31.52
Erannis spp.	1				11		0.1670	12	
Boarmia sp.					1		0.0270	1	
Geometridae indet.	18		4		5		0.5898	27	
Tetheidae indet.	1	0.16					0.0035	1	0.09
Lepidoptera larva indet.	13	26.67	1	0.73			0.5996	14	14.44
Diptera									
Limoniidae indet.	1	0.27					0.0060	1	0.18
Bibionidae indet.	1	0.09			1	0.59	0.0110	2	0.27
Tachinidae indet.					2	1.32	0.0200	2	0.45
Diptera indet.	1	0.27			1	0.73	0.0170	2	0.40
Hymenoptera									
Tenthredinidae indet.	1	0.07					0.0015	1	0.04
Phalangiidea									
Phalangiidae									
Zacheus crista	1	2.70					0.0600	1	1.08
Araneidea									
Argiopidae									
Araneus strumii					2		0.0085	2	
Araneus cucurbitinus			1		11		0.0605	12	
Araneus angulatus		1.01		2.47	3	5.87	0.0120	3	2.92
Araneus gibbosus	2						0.0113	2	
Araneus triguttatus	1						0.0111	1	
Zillodia sp.					1		0.0090	1	
Thomisidae									
Xysticus lanio	1		3		12		0.2208	16	
Xysticus ulmi	1						0.0650	1	
Xysticus spp.		4.09		13.10	2	20.16	0.0460	2	10.83
Philodromus aureolus	2		2		4		0.0646	8	
Misumena vatia			2				0.0172	2	
Misumenops tricuspidatus					5		0.0360	5	
Linyphidae									
Linyphia sp.	1	2.03					0.0450	1	1.08

Appendix 1. (Cont.)

Taxa	1978		1979		1980		Total (three years)		
	n	%	n	%	n	%	g dry wt	n	%
Clubionidae									
Clubiona coerulescens					2		0.0030	2	
Clubiona spp.					2	3.20	0.0215	2	1.16
Chiracanthium sp.					1		0.0090	1	
Salticidae									
Carrhotus bicolor			1	1.06			0.0043	1	0.10
Araneidea cocon indet.	1	1.62	2	4.49			0.0542	3	1.31
Others (plant debris, grit, snail shell, indet.)		0.27		1.97		3.91	0.0733		1.76
Total	82		37		162		4.0680	281	

Appendix 2. Food composition of the great tit nestlings (percentage values given in dry weight)

Taxa	1978		1979				1980					Total (three years)		
			May	June	total (two months)		May	June	July	Total (three months)				
	n	%	%	%	n	%	%	%	%	n	%	g dry wt	n	%
Isopoda														
Armadillidiidae														
Armadillidium vulgare								0.09		1	0.06	0.0050	1	0.03
Orthoptera														
Tettigoniidae														
Pholidoptera fallax				1.32	2	0.56						0.0408	2	0.30
Tettigoniidae indet					1							0.0160	1	
Homoptera														
Cicadidae														
Cicadetta montana					2							0.0345	2	
Cicadetta tibialis				2.99	3	1.27						0.0541	3	0.67
Cicadetta spp.					3							0.0406	3	
Cercopidae indet.				0.10	3	0.04						0.0042	3	0.02
Coleoptera														
Staphylinidae indet.			0.14		1	0.08						0.0080	1	0.04
Elateridae														
Athous rufus					1							0.0092	1	
Agriotes pilosus			0.44			0.25	2.24			3	0.43	0.0358	3	0.32
Elateridae indet.					4							0.0143	4	
Cerambycidae														
Cortodera humeralis							0.72			1	0.14	0.0115	1	0.06
Coleoptera indet.	4	3.14	0.08		1	0.04						0.0304	5	0.16
Lepidoptera														
Notodontidae														
Drymonia chaonia			1.92		2	1.10						0.0748	2	0.58
Drymonia sp.					1							0.0372	1	
Lymantriidae														
Dasychira pudibunda			1.06		2	0.61						0.0618	2	0.32

Lepidoptera																									
Notodontidae																									
Drymonia chaonia																							0.0748	2	
Drymonia sp.																							0.0372	1	
							1.92			2		1.10													0.58
										1															
Lymantriidae																									
Dasychira pudibunda							1.06			2		0.61											0.0618	2	0.32
Noctuidae																									
Conistra sp.																							0.0173	1	
Noctuidae indet.							1.79		0.40	1		1.20											0.1049	3	0.64
										3															
Lepidoptera indet.							0.71			2		0.41											0.0955	2	0.22
Lepidoptera pupa																									
Noctuidae																									
Hadena sp.																							0.0172	1	
Noctuidae indet.									0.40	1		0.17			4.69			2		0.65			0.0540	2	0.37
Lepidoptera indet.							0.37		2.37	10		1.22											0.1298	10	0.64
Lepidoptera larva																									
Tortricidae indet.							0.50			3		0.29											0.0294	3	0.15
Zygaenidae																									
Procris spp.							1.46			5		0.84											0.0885	5	0.44
Notodontidae																									
Drymonia chaonia									12.03	18		5.11			3.83		11.11	9		4.12			0.8587	27	4.46
Lymantriidae																									
Hypogymna morio																		1					0.0070	1	
Lymantria dispar									2.70	4		1.15		2.31				1		0.45			0.1465	5	0.80
Noctuidae																									
Orthosia stabilis										31													0.5722	31	
Orthosia incerta																		3					0.0900	3	
Orthosia schmidtii																		3					0.0330	3	
Orthosia munda	5																	7					0.5590	12	
Orthosia cruda										6								1					0.1429	7	
Orthosia miniosa										1													0.0122	1	
Orthosia spp.										39								6					1.0032	45	
Eupsilia transversa																		12					0.3560	12	
Diloba coeruleocephala																		1					0.0300	1	
Apatele rumicis																		2					0.0440	2	
Tholera decimalis		46.69			20.94			43.04		1		30.32		8.55		20.59		28.99			19.49		0.0270	1	26.37
Tholera cespitis										2													0.1127	2	
Allophyes oxyacanthae										2													0.0578	2	
Amphipyra pyramidea										35								9					1.4444	44	
Conistra erythrocephala										1													0.0325	1	
Conistra spp.										2								1					0.0395	3	

erythrocephala					1								0.0325	1	
Conistra spp.					2						1		0.0395	3	
Agrochola spp.					2						3		0.0839	5	
Apamea sp.					1								0.0225	1	
Noctuidae indet.					13						9		0.4396	22	
Geometridae															
Colotois pennaria					48						81		4.1952	129	
Phygalia pilosaria											4		0.1880	4	
Erannis defoliaria											1		0.0230	1	
Erannis spp.					2								0.0246	2	
Lycia hirtaria		17.30	25.97	15.58		20.99	42.76	42.04	10.59	1		37.79	0.0560	1	28.04
Boarmia spp.										5			0.1730	5	
Biston spp.					4								0.1350	4	
Ennomos sp.					1								0.0220	1	
Geometridae indet.	2				20					2			0.5407	24	
Tetheidae indet.				0.63	2	0.27							0.0270	2	0.14
Lasiocampidae															
Lasiocampa trifolii									25.34	4		3.54	0.2920	4	1.52
Lepidoptera indet.	2	5.56	3.72		23	2.14		0.04		1		0.02	0.2119	26	1.38
Diptera															
Tipulidae															
Tipula spp.			24.89		67	14.32	13.92			9		2.70	1.6408	76	8.72
Bibionidae															
Bibio marci							0.69			1		0.13	0.0110	1	0.06
Limoniidae indet.			0.43		3	0.25							0.0250	3	0.13
Syrphidae indet.									1.00	1		0.20	0.0160	1	0.08
Diptera indet.	1	0.73	0.48	0.66	9	0.56							0.0683	10	0.33
Hymenoptera															
Tenthredinidae indet.	1	0.34		0.11	1	0.05							0.0074	2	0.04
Hymenoptera indet.			0.26		1	0.14							0.0150	1	0.08
Araneidea															
Dysderidae															
Harpactes rubicundus			0.42		2	0.24							0.0210	2	0.13

Drassidae																			
Drassodes silvestris														1			0.0125	1	
Drassodes lepidosus											2.97			1	0.58		0.0350	1	0.25
Argiopidae																			
Araneus diadematus							4										0.0372	4	
Araneus bituberculatus							1										0 0132	1	
Araneus cucurbitinus							3							1			0.0585	4	
Araneus angulatus														3			0.0300	3	
Araneus gibbosus														1			0.0090	1	
Araneus sturmi														1			0.0055	1	
Araneus spp.														2			0.0215	2	
				0.23		1.41		0.73		0.91		1.32			1.06				0.84
Thomisidae																			
Xysticus lanio							11							16			0.5408	27	
Xysticus kochi	1						1										0.0360	2	
Xysticus cambridgei							2										0.0319	2	
Xysticus ulmi							1										0.0210	1	
Philodromus aureolus							13							23			0.4619	36	
Thanatus formicinus			3.39	2.34		5.18	1		3.55			15.82	11.41		12.12		0.0210	1	7.22
Pistius truncatus														2			0.0560	2	
Misumena vatia							1										0.0040	1	
Misumenops tricuspidatus														9			0.1460	9	
Synaema ornatum														1			0.0125	1	
Clubionidae																			
Chiracanthium elegans							8										0.1078	8	
Clubiona terrestris							1										0.0111	1	
Clubiona sp.				0.46		2.96	1		1.52								0.0012	1	0.80
Micrommata virescens							2										0.0316	2	
Agelenidae																			
Tegenaria silvestris				0.31			2		0.18								0.0159	2	0.09

Pisauridae															
Pisaura mirabilis	1	5.44	1.17		3	0.67	4.71	2.82		7	3.06	0.3417	11	1.90	
Lycosidae															
Alopecosa aculeata	1									4		0.2250	5		
Alopecosa schulzeri	1	16.81	8.15		3	4.69	14.23			2	2.76	0.1631	6	4.38	
Alopecosa cuneata	1				1							0.0464	2		
Alopecosa trabalis					18							0.3692	18		
Salticidae															
Carrhotus bicolor					3	0.34			2.60	1	0.25	0.0417	4	0.29	
Marptusa radiata			0.19	0.53	1							0.0114	1		
Araneidea indet.	1	0.60	0.19		2	0.11						0.0160	3	0.08	
Araneidea cocon indet.			0.27	3.27	16	1.54		2.08	13		1.39	0.3397	29	1.41	
Acaridea															
Ixodidae															
Ixodes ricinus				0.02	2	0.01						0.0014	2	0.01	
Others (plant debris, grit, snail shell, indet)			2.10	4.30		3.05	4.99	10.99	5.27		9.06	0.6815		5.49	
Total	21				492					273		18.7961	786		

Nematological Notices, 2

By

I. ANDRÁSSY*

I. Once again: nematodes parasitic in nematodes

It is a true rarity to observe parasitic nematodes within the body of other nematodes; hardly a few data can be counted about this phenomenon in the world literature. I was however lucky enough in this respect and could repeatedly publish some informations on these curious small worms (ANDRÁSSY, 1971, 1978, 1981). Even now, I can give an account of a recent observation.

In a mature female specimen of *Iotonchus zschokkei* (MENZEL, 1913) ALTHERR, 1955 I found two individuals of a small parasitic nematode. They were observed in the body cavity of the host, more nearly, one of them was situated somewhat behind the cardia – but outside of the intestinal canal! – and the other in the tail, a little behind the anal opening (Fig. 1). Both specimens were very small in comparison with the host, to measure their exact lengths was however not possible in consequence of their twisted or knotted position. Although the closer taxonomic status was not to be stated, they belonged most probably to the genus *Nanomermis* COBB, 1924.

Locality: Dömös, Pilis Mountains in Hungary, oak litter, September 1982.

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II. An additional list of genera and subgenera of free-living nematodes

To continue my lists on generic taxa of free-living Nematoda (ANDRÁSSY, 1976 and 1981), I give here the names of 87 genera and 13 subgenera (= 100 taxa) described in the latest years by 45 different authors. The orders of nematodes are represented by the following numbers of new generic taxa: Monhysterida (MO): 1, Desmoscolecida (DE): 5, Araeolaimida (AR): 1, Chromadorida (CH): 6, Rhabditida (RH): 2, Tylenchida (TY): 24, Enoplida (EN): 8, Dorylaimida (DO) 53.

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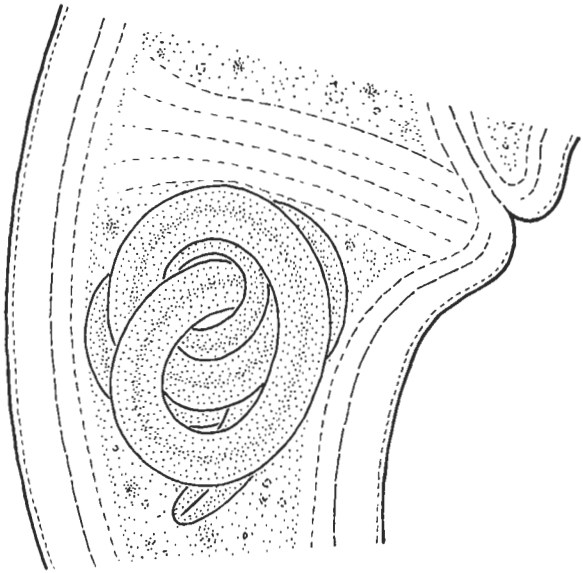

Fig. 1. A small parasitic nema (*Nanomermis* sp.) in the tail of a female *Iotonchus zschokkei* (MENZEL, 1913) ALTHERR, 1955

Acephalodorylaimus Ahmad & Jairajpuri, 1983	DO: Nordiidae
Acrozostron Orton Williams, 1981	TY: Criconematidae
Afrina Brzeski, 1981	TY: Anguinidae
Allotylenchus Andrássy, 1984	TY: Tylenchidae
Amazonema Siddiqi, 1983	DO: Dorylaimellidae
Amphisbaenema Orton Williams, 1982	TY: Criconematidae
Antarcticonema Timm, 1978	DE: Greeffiellidae
Aphelechus (*Anaphelenchus* Anderson & Hooper, 1980)	TY: Aphelenchidae
Apoleptonchus Siddiqi, 1982	DO: Leptonchidae
Axonchium (*Spiculaxonchium* Ahmad & Jairajpuri, 1982)	DO: Belondiridae
Boucherius Decraemer & Jensen, 1981	DE: Meyliidae
Brevinema Stegarescu, 1980	DO: Longidoridae
Brevitobrilus Thalolikhin, 1981	EN: Tripylidae
Capilonchus Siddiqi, 1982	DO: Tylencholaimidae
Capitellus Siddiqi, 1983	DO: Dorylaimellidae
Caveonchus Siddiqi, 1982	DO: Leptonchidae
Cephalochaetosoma Kito, 1983	CH: Draconematidae
Cerchnotocriconema Bernard, 1982	TY: Criconematidae
Comesomoides Gourbault, 1980	CH: Comesomatidae
Comiconchus Jairajpuri & Khan, 1982	DO: Mononchidae
Coronatyleptus Siddiqi, 1982	DO: Leptonchidae
Crossonemoides Eroshenko, 1981	TY: Criconematidae
Curvidorylaimus Jairajpuri & Rahman, 1983	DO: Tylencholaimidae

Distolabrellus Anderson, 1983	RH: Rhabditidae
Dolichodera Mulvey & Ebsary, 1980	TY: Heteroderidae
Dorylaimellus (*Axodorylaimellus* Jairajpuri & Ahmad, 1980)	DO: Dorylaimellidae
Dorylaimellus (*Belondorylaimellus* Jairajpuri & Ahmad, 1980)	DO: Dorylaimellidae
Dorylaimellus (*Clavidorylaimellus* Jairajpuri & Ahmad, 1980	DO: Dorylaimellidae
Dorylaimellus (*Elongidorylaimellus* Jairajpuri & Ahmad, 1980)	DO: Dorylaimellidae
Dorylaimellus (*Filidorylaimellus* Jairajpuri & Ahmad, 1980)	DO: Dorylaimellidae
Dorylaimellus (*Mesodorylaimellus* Jairajpuri & Ahmad, 1980)	DO: Dorylaimellidae
Dorylaimellus (*Metadorylaimellus* Jairajpuri & Ahmad, 1980)	DO: Dorylaimellidae
Dorylaimellus (*Prodorylaimellus* Jairajpuri & Ahmad, 1980)	DO: Dorylaimellidae
Duotylenchus Saha & Khan, 1981	TY: Tylenchidae
Echinodesmodora Blome, 1982	CH: Desomodoridae
Enchodelus (*Nepalus* Ahmad & Jairajpuri, 1980)	DO: Nordiidae
Enchodelus (*Paraenchodelus* Ahmad & Jairajpuri, 1980)	DO: Nordiidae
Enchodelus (*Rotundus* Ahmad & Jairajpuri, 1980)	DO: Nordiidae
Ephippiodera Shagalina & Krall, 1981	TY: Heteroderidae
Epitobrilus Thalolikhin, 1981	EN: Tripylidae
Eutobrilus Thalolikhin, 1981	EN: Tripylidae
Fuscheila Siddiqi, 1981	DO: Thornenematidae
Glochidorella Siddiqi, 1982	DO: Leptonchidae
Gymnotyleptus Ahmad & Jairajpuri, 1982	DO: Tylencholaimellidae
Hadronchulus Ray & Das, 1983	DO: Mononchidae
Heteroanguina Chizhov, 1980	TY: Anguinidae
Hoplorhynchus Andrássy, 1985	TY: Hoplolaimidae
Hulqus Siddiqi, 1982	DO: Discolaimidae
Ibadanus Siddiqi, 1983	DO: Dorylaimellidae
Inagreius Khan, 1981	DO: Longidoridae
Jamilius Siddiqi, 1983	DO: Dorylaimellidae
Jensenonchus Jairajpuri & Khan, 1982	DO: Mononchidae
Kantbhala Siddiqi, 1982	DO: Tylencholaimidae
Karkinochromadora Blome, 1982	CH: Chromadoridae
Labronemella Andrássy, 1985	DO: Qudsianematidae
Latocephalus Patil & Khan, 1982	DO: Qudsianematidae
Leptepsilonema Clasing, 1983	CH: Epsilonematidae
Listia Blome, 1982	AR: Leptolaimidae
Macrotobrilus Thalolikhin, 1981	EN: Tripylidae
Mammillonema Darekar & Khan, 1982	DO: Qudsianematidae
Megaonchulus Jairajpuri & Khan, 1982	DO: Mononchidae
Mesotobrilus Thalolikhin, 1981	EN: Tripylidae

Miconchoides Jairajpuri & Khan, 1982	DO: Mononchidae
Moshajia Siddiqi, 1982	DO: Crateronematidae
Mulveyotus Anderson & Ebsary, 1982	TY: Tylenchorhynchidae
Nenocriconema Darekar & Khan, 1981	TY: Criconematidae
Neobakernema Ebsary, 1981	TY: Criconematidae
Neocrossonema Ebsary, 1981	TY: Criconematidae
Neodiscolaimium Patil & Khan, 1982	DO: Qudsianematidae
Neotobrilus Thalolikhin, 1981	EN: Tripylidae
Noffsingeria Decraemer & Jensen, 1981	DE: Meyliidae
Nothocriconemella Ebsary, 1981	TY: Criconematidae
Notholetus Ebsary, 1981	TY: Criconematidae
Orrina Brzeski, 1981	TY: Anguinidae
Paktylenchus Maqbool, 1983	TY: Tylenchidae
Paramylonchulus Jairajpuri & Khan, 1982	DO: Mylonchulidae
Paraqudsiella Siddiqi, 1982	DO: Swangeriidae
Pararotylenchus Baldwin & Bell, 1981	TY: Hoplolaimidae
Paroriverutus Carbonell & Coomans, 1982	DO: Qudsianematidae
Promiconchus Jairajpuri & Khan, 1982	DO: Mononchidae
Promumtazium Siddiqi, 1982	DO: Tylencholaimidae
Prorhynchonema Gourbault, 1982	MO: Xyalidae
Raritobrilus Thalolikhin, 1981	EN: Tripylidae
Rasidanema Siddiqi, 1983	DO: Dorylaimellidae
Saevadorella Siddiqi, 1982	DO: Nordiidae
Sclerostylus Goseco, Ferris & Ferris, 1981	DO: Leptonchidae
Seleborca Andrássy, 1985	RH: Cephalobidae
Semitobrilus Thalolikhin, 1981	EN: Tripylidae
Seshadriella Darekar & Khan, 1981	TY: Criconematidae
Sicorinema Siddiqi, 1982	DO: Crateronematidae
Sindellus Siddiqi, 1983	DO: Dorylaimellidae
Stygodesmodora Blome, 1982	CH: Desmodoridae
Tantunema Siddiqi, 1982	DO: Tylencholaimidae
Tarjanius Ferris, Goseco & Ferris, 1980	DO: Oxydiridae
Triepsilonema Decraemer, 1982	DE: Epsilonematidae
Trilineellus Lewis & Golden, 1981	TY: Tylenchorhynchidae
Tubixaba Monteiro & Lordello, 1980	DO: Aporcelaimidae
Usarpnema Timm, 1978	DE: Desmoscolecidae
Verutus Esser, 1981	TY: Heteroderidae
Zalophidera Siddiqi, 1982	DO: Tylencholaimidae

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